THE

Practical Teacher

A MONTHLY EDUCATIONAL JOURNAL.

Edited by JOSEPH HUGHES.

'Knowledge is proud that he has learned so much.
Wisdom is humble that he knows no more.'—COWPER.

VOL. X. NO. 4 JUNE, 1890. PRICE, 6D. POST FREE, 7½D.

Honours Hygiene.

BY

ARTHUR NEWSHOLME, M.D., D.P.H. UNIV. LOND.,

Medical Officer of Health for Brighton.

EXERCISE.

Muscular exercise has a most important influence on health. Its effect in increasing all vital processes is strikingly shewn by the increased amount of air inspired and of carbonic acid expired during active exercise. Dr. Edward Smith found that if the air inspired when lying down be represented by unity, the amount inspired when erect was in the same length of time 1.33; when walking at the rate of one mile an hour 1·9; at three miles an hour 3·23; at six miles an hour 7; riding on horseback 4·05; swimming 4·33. Or putting it in another way, under ordinary circumstances a man inspires about 480 cubic inches per minute; if he walks three miles an hour (480 × 3·23 =) 1,550 cubic inches per minute; if six miles an hour (480 × 7 =) 3,360 cubic inches per minute. (*Newsholme's 'Hygiene,'* page 318).

The amount of carbonic acid gas eliminated is also greatly increased by exercise. Dr. Edward Smith's experiments gave the following results:—

	Amount of CO_2 eliminated per minute.	Proportions, taking amount during rest as unity.
During rest	13·11 grains.	1
Walking at two miles per hour and carrying 7 lbs.	24·26 ,,	1·85
Walking at three miles per hour...	34·66 ,,	2·64
On tread-wheel, when lifting 196 lbs. through 1,920 feet per hour	57·68 ,,	4·40

The experiments of Pettenkofer and Voit, which were carefully made, show the following results as regards the daily absorption of oxygen and the elimination of carbonic acid, water, and urea.

	Absorption of Oxygen in grammes.	Elimination in Grammes of— Carbonic Acid.	Water.	Urea.
Rest-day... ...	708·9	911·5	828·0	37·2
Work-day ...	954·5	1284·2	2042·1	37·

The increased elimination of carbonic acid during active work renders necessary a greater supply of fresh air under these circumstances than is necessary in bedrooms or private houses generally.

The *amount of work done* by a healthy adult per diem is variously stated by different physiologists. It is stated by M. Foster to be about 150,000 metre-kilogrammes (*i.e.*, 150,000 kilogrammes lifted 1 metre). Metre-kilogrammes can be converted into foot-pounds by multiplying by 7·233; into foot-tons by multiplying by ·003229; 150,000 metre-kilogrammes therefore equals 484·35 foot-tons. This is considerably in excess of Dr. Parkes' estimate, who gives 250 to 350 foot-tons as the average amount of daily work done by a man engaged in manual labour in the open air. Dr. Parkes considers that an amount of work represented by the lifting of 500 tons one foot is an extremely hard day's work. In certain laborious occupations this high amount is reached, but 300 tons lifted one foot is an average day's work for a healthy strong adult.

In addition to this amount of external work, there is the internal work of the heart, muscles of respiration, digestion, &c. This is estimated by Parkes at about 260 foot-tons.

The internal and external muscular work of the body together amount to about 1-7th to 1-8th of the total force obtainable from the food.

Professor Haughton has shewn that walking on a level surface at the rate of three miles an hour is equivalent to raising the walker's own weight, *plus* the weight he carries, through $\frac{1}{20}$ of the distance walked.

Thus if W = weight of the man,
W^1 = weight carried by him,
D = distance walked in feet,
C = co-efficient of traction ($\frac{1}{20}$ at three miles an hour),

then we obtain by the following formula the amount of work done. The co-efficient of traction is multiplied by 2,240 (the number of pounds in a ton) to obtain the result in foot-tons.

$$\frac{(W + W^1) \times D}{C \times 2{,}240}$$

In ascending a height, a man raises his whole weight through the height ascended.

Example 21.—A regiment of soldiers marches ten miles, each carrying a weight of 60 lbs. (nearly the weight a soldier carries when in marching order). What amount of work is performed by each soldier?

If we assume the average weight of each to be 150 lbs., and that the march was at the rate of three miles an hour, then—

$$\frac{(150 + 60) \times 10 \times 5{,}280}{20 \times 2{,}240} = \underline{247{\cdot}5 \text{ foot-tons.}}$$

This represents a moderate day's work.

In this example it is assumed that the march is on entirely level ground, that all weights are carried in the most convenient manner, and that the rate of travel is three miles an hour. Velocity is gained at the expense of carrying power. It has been found that the amount of work is generally inversely as the square of the velocity. Dr. Haughton has determined from Weber's calculations the co-efficient of resistance for three velocities.

Velocity.	Co-efficient of Traction.
1·818 miles per hour	$\frac{1}{28{\cdot}27}$
4·353 " "	$\frac{1}{13{\cdot}70}$
10·577 " "	$\frac{1}{7{\cdot}51}$

Dr. Parkes has extended these calculations and gives the following table to show the distance required to be travelled at various velocities to do work equal to 300 foot-tons, and the time required in each instance.

Velocity in Miles per Hour.	Co-efficient of Resistance.	Distance for Men of 160 lbs. to equal 300 foot-tons.	Time required in Hours and Minutes.
			hrs. mins.
2	$\frac{1}{26{\cdot}74}$	21·2	10 ... 36
3	$\frac{1}{20{\cdot}59}$	16·3	5 ... 24
4	$\frac{1}{16{\cdot}74}$	13·3	3 ... 18
5	$\frac{1}{14{\cdot}10}$	11·2	2 ... 36
6	$\frac{1}{12{\cdot}18}$	9·6	1 ... 36
7	$\frac{1}{10{\cdot}72}$	8·5	1 ... 12
8	$\frac{1}{9{\cdot}60}$	7·6	0 ... 57
9	$\frac{1}{8{\cdot}65}$	6·9	0 ... 40
10	$\frac{1}{7{\cdot}89}$	6·3	0 ... 38

The co-efficient $\frac{1}{31{\cdot}6}$ corresponds very nearly to 3·1 miles per hour, and it appears that at this rate of travel the greatest amount of work can be done with the least expenditure of energy.

Example 22.—How much work is done by a man walking at 4 miles an hour, a distance of 15 miles; his weight and the weight he carries equalling together 12 stone 8 lbs.?

$$\frac{176 \times 15 \times 5{,}280}{16{\cdot}74 \times 2{,}240} = \underline{371{\cdot}7 \text{ foot-tons.}}$$

Example 23.—How much work is done by a man weighing 150 lbs. who walks 15 miles up an incline 1 in 200?

The number of feet ascended in 15 miles

$$= \frac{5{,}280 \times 15}{200} = 396.$$

The amount of work done by the man in raising his own weight 396 feet high

$$= \frac{396 \times 150}{2{,}240} = \underline{26{\cdot}5 \text{ foot-tons.}}$$

The amount of work done in walking 15 horizontal miles at rate of 3 miles an hour

$$= \frac{150 \times 15 \times 5{,}280}{20 \times 2{,}240} = 265{\cdot}2 \text{ foot-tons.}$$

Total amount of work done = 265·2 + 26·5

$$= \underline{291{\cdot}7 \text{ foot-tons.}}$$

Example 24.—Eight palanquin bearers carry an officer weighing 180 lbs. and a palanquin weighing 250 lbs., a distance of 25 miles. Assuming that each man weighs 150 lbs., what amount of work was done by each man? (*Parkes.*)

$$250 + 180 = 430$$
$$150 \times 8 = 1{,}200$$
$$W + W^1 = 1{,}630$$
$$\frac{1{,}630 \times 25 \times 5{,}280}{20 \times 2{,}240} = \underline{5{,}094 \text{ foot-tons.}}$$

This being the total work done, the work per man = nearly 637 foot-tons.

Example 25.—A hill-coolie weighing 150 lbs. goes 30 miles with an ascent of 5,500 feet in three days, carrying 80 lbs. weight. What is the work per day? (*Parkes.*)

$$\text{Work of the ascent} = \frac{(150 + 80) \times 5{,}500}{2{,}240}$$

= about 564 foot-tons.

Work of 30 miles walk

$$= \frac{230 \times 30 \times 5{,}280}{20 \times 2{,}240} = 813 \text{ foot-tons.}$$

Total work = 564 + 813 = 1,377

Total work per day = $\frac{1377}{3}$ = <u>459 foot-tons.</u>

Example 26.—If a man 20 stone in weight and carrying 20 lbs. weight, walks 10 miles per day up a hill which is 500 feet high, what work does he do?

$$\frac{(280 + 20)\ 10 \times 5280}{20 \times 2240} = 353{\cdot}5 \text{ foot tons}$$

500 × 300 = 150,000 foot pounds = 67 foot tons

Total work done = <u>420·5 foot tons.</u>

Example 27.—If a man 180 lbs. in weight, wishes to expend 200 foot tons of energy, how far must he walk?

$$\frac{180 \times D}{20 \times 2240} = 200$$

Therefore D = <u>9·4 miles.</u>

Example 28.—Suppose a man weighing 150 lbs. in his clothes, carries a load of bricks weighing 35 lbs. up a perpendicular ladder 30 ft. high 100 times daily, what amount of work does he do; and what will it equal in miles walked upon a flat road at the rate of 3 miles an hour?

$$\frac{(150 + 35) \times 30 \times 100}{2240} = 248 \text{ foot tons}$$

$$\frac{185 \times D}{20 \times 2240} = 248$$

Therefore D = 60056 feet

= about 11·4 miles.

Example 29.—How much exercise ought to be taken daily for health? How is work calculated? Suppose a man strikes 12,000 strokes in 5 hours with a 14-lb. hammer, raising it at each stroke 4 feet, how much work does he do? Compare this with a walk of 15 miles on a level ground at 3 miles an hour, the weight of the man and what he carries being 180 lbs. *(University of London: Public Health Examination, 1884).*

(*a*) $12000 \times 14 \times 4 = 672000$ foot lbs. of work

$= 300$ foot tons

(*b*) $\frac{180 \times 15 \times 5280}{20 \times 2240} = 318{\cdot}2$ foot tons.

The two amounts of work are related as 300 : 318·2.

(To be continued.)

—o—

How a Scotch School was Examined.

INFANT DEPARTMENT.

Singing.—One action song—'The Cooper.'

Modulator Exercise.—The inspector pointed the following exercise:—d r m s d' t l s f m r m s d' s n d r d m d s d f d m l s d.

Reading.—The highest class alone read a sentence each and spelled orally a few easy words, while the younger ones wrote as many capital letters as they could.

Object Lesson.—'The sheep.'

Arithmetic.—The highest class added on slates 15 + 20 + 17 + 4, while the inspector asked the others such questions as:—3 and 4? 5 and 6? 7 and 3? 4 and 5 more? how many legs have 3 chairs? how many legs have two sheep? 4 from 6? 6 from 10? 5 and what make 9? 6 and what make 12? John has 7 apples and gives 4 away, how many has he left? Tom has 8 apples and John 12; how many has John more than Tom?

STANDARD I.

Reading.—Every one read from Star Reader No. I., and answered a few questions on the matter read.

Writing.—Each one copied from book.

Arithmetic.—

(1) 946 + 793 + 447 + 276 + 385.

(2) 786 + 390 + 408 + 514.

(3) Take 687 from 915.

STANDARD II.

Reading.—Every second child read a sentence from Star Reader No. II., answered questions and pointed out a few nouns and verbs.

Writing.—Copy books were inspected and the following lines were dictated by the teacher of the class:—'Sometimes he will make an attack on one part of a village, to draw the people to that side, and then quietly steal round.'

Arithmetic.—

(1) 9,276 + 860 + 79 + 447 + 6,809 + 7,046.

(2) From 82,813,041 take 26,681,486.

(3) Multiply 3,868,497 by 4.

STANDARD III.

Reading.—Every one read from Star Reader No. III. 'The Truant Squirrel,' page 99, answered questions on meanings of words and phrases, and pointed out predicates, subjects and objects from sentences selected by the Inspector from the lesson read.

Writing.—The following lines were dictated and written on paper:—'They sup, as they breakfasted, upon the kernels of the fruits, and then they go to the water to bathe once more. Again follows the business of pluming their feathers, and after this they go to rest for the night. But they do not roost in the branches.'

Arithmetic.—

A. (1) Multiply eight hundred and six thousand seven hundred and ninety-four by four thousand eight hundred and seven.

(2) Divide three hundred and six thousand two hundred and seventeen by four hundred and fifty-nine.

(3) Divide six hundred and eight thousand three hundred and seventy-five by seventy-eight.

(4) Take £395 17s. 9¾d. from £1,063 3s. 9½d.

B. (1) Divide four hundred and sixteen thousand three hundred and fifty-seven by six hundred and fifty-eight.

(2) Multiply nine hundred and eight thousand seven hundred and sixteen by four thousand and fifty-seven.

(3) Multiply 690,875 by 694.

(4) Add together £3 19s. 10¾d.; £805 12s. 6½d.; £498 2s. 11¼d.; £914 19s. 11¼d.; £85 4s. 6½d.

Geography.—A pupil teacher examined the class on Scotland; boundaries, position of counties, capes on east and south coasts, rivers flowing into the German ocean, courses of the four largest rivers with any towns that the children knew, Lowland hills, cotton and linen industries and where carried on, what things required to be imported. The inspector gave hints and questions during the lesson.

History.—After getting an exhaustive outline of the life and adventures of Robert Bruce, the Inspector proceeded to deal with the reign of Mary, asking notes on Knox, Wishart, Cardinal Beaton, the Reformation in Scotland, Darnley, Rizzio, and the Earl of Bothwell, finishing with Mary's life in England, her trial and death in Fotheringay.

Repetition.—'The Lighthouse,' page 179. Each one repeated two lines or so, and then answered one question on the meanings of words and phrases.

STANDARD IV.

Reading.—Each one read a sentence from 'The Wolf,' page 107, Star Reader Nc. IV. Questions followed on the words and phrases in the lesson. Parsed every word in the sentence, 'An old woman had gone to a neighbour's house for the loan.' The following sentences were read by the Inspector and analysed by the scholars:—

(1) 'On her way home she met a prowling wolf.'

(2) 'There still remain in Scotland a few dogs of a breed once called the wolf-hound.'

(3) 'Once a Russian noble and his wife were chased by a pack of wolves.'

(4) 'On reaching the gate at the entrance to the house he found it closed.'

Writing.—Dictation.—During the colder months of the year, when the rivers and lakes are frozen, it is constantly engaged in the capture of sea-fish. In the summer it quits the ocean, and, accompanied by its mate, it seeks the rivers and fresh-water lakes of North America.

Every year a fleet of light boats, covered with seal-skin, is engaged in its chase. The boats form into a long line, leaving spaces between them.

Arithmetic.—A. (1) Multiply £25 17s 6¼d. by 370.

(2) Divide 92 acres 5,116 poles by 960.

(3) Reduce to inches 6 furlongs 7 chains 15 yards.

(4) Find the difference between 3,000 halfpence and 660 threepenny pieces.

B. (1) Divide £5,574 2s. 8½d. by 370.

(2) Reduce 33,600 ounces to cwts.

(3) Multiply 12 qrs. 6 bush. 3 qts. by 47.

(4) A man sells a horse for £35 and buys sheep at 25s. each; what has he left?

C. 1. Multiply 5 miles 210 acres 3 roods 2 poles by 960.

(2) Divide £76,513 10s. 6d. by 6,072.

(3) Find the difference between 33,615 ounces and 75 stones in ounces.

(4) A boy saves 3d. per week. How much will he save in six years.?

History.—Reigns of James I., Charles I., and the events leading to the establishment of the Commonwealth with a detailed account of the life of Cromwell.

Geography.—Ireland, very particularly coast-line—maritime counties—rivers Shannon, Lee, Liffey and Bann specially—seaports—trade and products.

Repetition.—'Lord Ullin's Daughter' and 'The Battle of Hohenlinden.'—Each one repeated a verse, and questions followed as in Standard III.

STANDARD V.

Reading.—Each one read a sentence or two from Star Reader No. V., the lesson being 'Buried in an Avalanche,' page 110.

A very few questions were asked on meaning of words and phrases.

Writing.—'The big drummer in a volunteer band was a very short man, but he had a good opinion of his own importance. Wishing to make the most of his stature, he held the drum so high that he could not see the musicians in front of him. The band, when out, usually marched in the same direction. One day, however, the conductor turned down another street for a change. The little drummer behind could not see this movement, and went on the old route drumming as hard as he could. When he stopped, he thought everything so very quiet, that he shifted his drum in order to see before him. He was awfully astonished at finding himself deserted, and stammered out to the wondering bystanders, "I say, have any of you people seen a band about here lately?"'

Arithmetic.—A. (1) Reduce 769,960 quarts to qrs.

(2) Make out and receipt a bill for:—

3 bars of soap, each 7½ lbs., at 3½d. per lb.
8½ lbs. tea at 2s. 10d. per lb.
114 eggs at 1s. 2d. per dozen.
25 melons at 1s. 3½d. each.

(3) If a loaf cost 7½d. when wheat is 60s. per quarter, what should the same loaf cost when wheat sells at 54s. a quarter?

(4) Divide ($\frac{3}{4}$ of $\frac{1}{8}$) + $2\frac{1}{4}$ by $1\frac{5}{16}$.

B. (1) Find by Practice the value of 478 articles at £2 13s. 4½d. each.

(2) Make out the following bill:—

8 stones of apples at 1s. 2d. for 7 lbs.
7 boxes figs at 3s. 2½d. per box.
15½ lbs. grapes at 10½d. per lb.
1,000 oranges at ½d. each.

(3) A woodcutter cuts down 7 trees in 5 hours; how many days of 10 hours each will be required to cut down a forest containing 2,072 trees?

(4) Multiply $2\frac{1}{4}$ by $3\frac{3}{4}$ of $\frac{4}{5}\frac{4}{5}$.

C. (1) Find by practice the value of 493 articles at £9 19s. 8½d. each.

(2) If a farmer digs a drain 3 miles long at the rate of 2s. 3½d. a chain, how much does it cost him (22 yards = 1 chain)?

(3) Make out and receipt a bill for:—

6 lbs. at 4½d. per lb.
3½ cwt. at 1s. 1d. per stone.
18 lbs. at 3s. 4d. per lb.
12½ lbs. at 4s. 9d. per stone.

(4) Simplify $(\frac{1}{5} + \frac{1}{6} + \frac{1}{8}) \div 1\frac{1}{2}$.

History.—The wars between England and France.

Geography.—Europe generally, with particular questions on Italy, France and Spain.

Repetition.—See Standard VI.

STANDARD VI.

Reading.—Reading with Standard V., pupils in VI. broke up passages into principal and complex sentences which those in V. analysed and gave reasons for.

Writing.—Essay on 'A Summer Day,' or 'A Ride into the Country.'

Arithmetic.—A. (1) Find the value of ·0625 of a mile + ·125 fur. + ·5 poles, and subtract it from $\frac{3}{16}$ of 4 miles.

(2) Simplify $\frac{\frac{19}{3} + \frac{11}{6}}{\frac{19}{3} - \frac{11}{6}} \div \frac{31}{9} - \frac{1}{3}$.

(3) Find the simple interest on £875 for 219 days at 5 per cent. per annum.

(4) If 4 cwts. 3 qrs. 14 lbs. are carried 31 miles 2 fur. for £2 os. 5d., what weight would be carried 125 miles for £1 12s. 4d.?

B. (1) If 20 men do a piece of work in 12 days, working 9 hours a day, in what time will 36 men do it, working 8 hours a day?

(2) Find the value of $\frac{4}{5}$ of 1 ton + $\frac{1}{16}$ of 1 cwt. + $\frac{5}{14}$ of 3 qrs. and reduce the result to the fraction of 1 ton 3 cwt. 2 qrs. 2 lbs.

(3) Multiply 1·075 by ·0101 and divide your answer by 43.

(4) Find the simple interest on £810 for 11 months at $2\frac{2}{3}$ per cent. per annum.

C. (1) Multiply 68·479 by ·084 and divide your answer by 84.

(2) Reduce 3 cwts. 3 qrs. 12 lbs. to the decimal of $1\frac{3}{4}$ tons.

(3) Find the simple interest of £794 for $1\frac{1}{2}$ years at $2\frac{1}{2}$ per cent. per annum.

(4) If 9 persons carry a weight 7 miles for £34 6s. 8d., what will be charged for 5 persons carrying the same weight 15 miles?

History.—Wars and constitutional changes in the present reign.

Geography.—Relative positions of the continents, with the physical features and political divisions of Europe and Asia.

Repetition.—Standards V. and VI. took their lines from 'The Trial Scene' (Merchant of Venice). The pupils were particularly warned to use the conversational tone while reciting.

MUSIC FOR STANDARDS III.—VI.

Modulator.—Key C. **m s fe s l se l t d' m' r' s r s m' d' s fe s d' ta l se l d' m' l f r t_1 s_1 d** with removes to right and left.

Sight Test.—Key C.

m :r :-	f :- :l	s :fe:s	d' :- :-	l :- :s
m :- :l	m' :t :d	f :- :r	t_1 :m :-	d :m :d

Ear Test (on harmonium).—**r f l ; s fe s ; d' t d' ; s m r d ; d f l s ; d f r d.**

Sewing taken as per Schedule.

Registers and Pupil Teachers' agreements inspected.

An Elementary Course in the Use of Wood Working Tools.

BY FRED. WILKINSON, F.G.S.,

Science Teacher under the Bolton School Board.

As the student will often require the jack plane, and as it will be impossible for the teacher to sharpen up for the student every time he needs it, we propose to next show how the tool may be taken to pieces readily by the student, and set up again by him.

Take the jack plane in the hand and notice the position of the cutting tool. It rests at an angle of about 45° with the sole. A blow struck vertically on the fore top part of the plane will cause the plane irons to start from their bed, and move in the opposite direction of the blow, that is, they will be loosened from their bed. As students, at first in striking the top of the plane, do not strike it with proper force, another method is often pursued, and which we now proceed to describe.

Take the plane in the left hand. Turn it over so that the sole of the plane is up, and the fore top part rests on the bench. Now, with the left hand hold the cutting iron, and wedge, and with right hand lift up the plane and strike it on the bench, allowing the top of the bench and the fore top part of the plane to meet each other perfectly parallel, and not in the slightest degree obliquely. It will be found that the wedge and irons are loosened, and they may be withdrawn at pleasure.

Now put the stock of plane on its side, with the wedge on the top of it. We next proceed to take the plane irons to pieces.

FIG. 32.

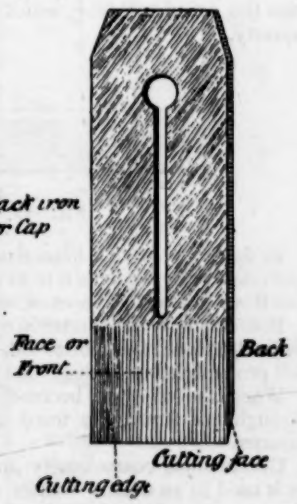


FIG. 33.

Fig. 32 shows the two fastened together by screw. Take the irons in the left hand and place the two flat upon the bench, but have the planing iron on the top, and the back iron resting on the bench. Now unscrew with right hand and screw driver, taking care to keep the elbow down in screwing and unscrewing. It is considered very bad form to hold the right elbow up in screwing. A few turns will suffice, and then the two

should be placed in left hand with back iron upwards. Now unscrew with right hand, and withdraw the back iron by left hand in the direction of the hole in the cutting iron. When the screw head arrives there, take the back iron out and put it on one side in a safe position.

Now we have the cutting tool alone, and we now next proceed to show how it may be sharpened and made ready for doing good work.

Fig. 33 shows the cutting tool when separated from the back iron.

Observe the chief parts: cutting edge, face, cutting face and back.

When the cutting edge has been working some time it becomes dulled, and from time to time needs sharpening. Before we go further, let us say a word or two about oil stones, or whet stones, as they are called.

Oil Stones.—Though not a tool in the strict sense of the word, it is nevertheless an indispensable auxiliary.

The term Hone or Whet Stone has been applied to a class of slate stones of varying compositions and degrees of hardness, all of which, however, are used in the sharpening of knives, razors, and edged tools, such as are used in wood working. In their nature they are slaty. There are many varieties which may be classed as follows:—

Very fine grained stones as the German Hone and Arkansas Stone.

Medium grained as, Water of Ayr Stone, Charnley Forest Stone, Washita Stone.

According to Holtzapffel, the Turkey oil-stone, exported from Smyrna, is the best of all stones. In its structure it is not slaty, although it has a density and hardness sufficient to abrade the hardest steel. According to another authority, no better stone exists than the American stone, which is largely used in this country.

FIG. 34.

In fig. 34 we have a hone fixed in a case. A good exercise for the students is to fit up a hone in the case; but this will come as an exercise later on.

It is essential that the surface of the hone should be perfectly plane and horizontal, as faulty sharpening will probably result if this is not attended to.

When the oil-stone becomes uneven or hollowed through use, it may be trued again in the following manner.

Obtain some coarse emery and an iron plate, such as is used in an oven. Scatter emery on this and put the uneven surface of the hone upon it. Now rub in a circular manner, applying vertical and equal pressure on the abraded surface. When fairly trued, obtain a little flour emery and finish off with that.

Now a word or two about the oil to be used. Olive oil is good and recommended by some, but neat's foot oil is preferred by many. Never use an oil which clogs and makes a dirty stone. By all means keep a clean stone. This is an important precaution and the student will see the advantage of it. As the stones used for sharpening purposes cannot be obtained in large pieces owing to geological processes, we are obliged to have small pieces and these of uniform shape and size, generally about 11 in. × 2 in. × 1½ in. thick.

We will now suppose the tool to be sharpened has left the grinding stone and wants the finished edge for cutting putting on.

We proceed as follows. Turn the face to the bench. Put the oil stone at right angles to front edge of bench as shown in figure 35.

Fig. 35.

Take the plane iron in the right hand and put the ground edge perfectly flat upon the stone. It will be observed, on referring to diagram 35, that the thumb of right hand is under the iron; the first two fingers on the top, the last two under. Put the thumb of the left hand under and first three fingers of the left hand on the top. We apply pressure only with this hand. The pushing and withdrawing of iron along the stone are done with right hand.

The width of the stone will be seen to be less than that of the tool to be sharpened, so that all the tool's edge cannot pass along the stone at the same time and some method must be adopted whereby the edge will be uniformly treated, or we may have very uneven work.

Looking down over figure 35 we get something like what we see in fig. 36.

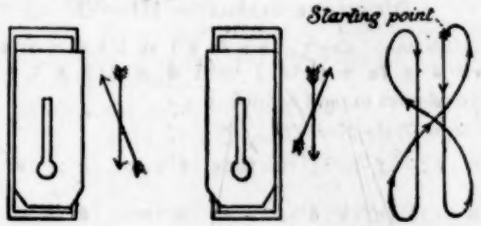


Fig. 36. Fig. 37. Fig. 38. Fig. 39. Fig. 40.

Now slowly at first move the tool straight to bottom end of stone; it will then be in same position but at the other end of the stone. Now move it diagonally to top of stone again. The arrows in fig. 37 show the two motions.

The tool will now be in the position as indicated in diagram 38.

Now it must be brought to bottom edge of stone again in a straight line. Then send it back again diagonally as shown by arrows in diagram 39.

We are now at our first position again. A combination of these movements is shown in diagram 40.

When in first position, the section of stone and iron is seen in diagram 41.

Fig. 41.

The grinding stone being convex will cause a body which has been ground to have the opposite form, viz., concave. In fig. 41 we have exaggerated this concavity, so that the student may know plainly the action of the grinding stone. This concavity must first be removed. The angle of the cutting face to face of tool is about 25°. Having got the cutting face flat on the stone, now tilt the tool about 10° higher, making angle now 35° and work as before.

Be careful not to round this face, but have the two planes as shown in diagram 42 and not as in 43.

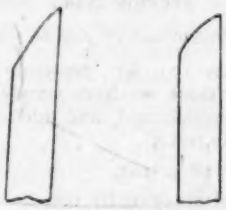


Fig. 42 and 43.

It will be plain that in sharpening the edge by the latter operation we have caused what is known as a burr to be formed along the cutting edge. This is in reality a steel shaving, and falls over the edge as shown in diagram 44.

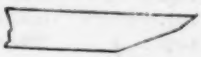


Fig. 44.

This must next be removed, and the following operation is gone through. Take the plane iron and put the front face on which we find the burr perfectly flat upon the stone as shown in diagram 45.

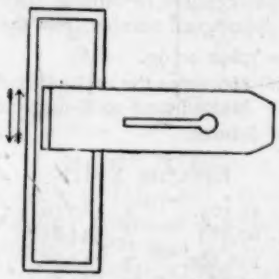


Fig. 45.

Now apply pressure and move up and down as indicated by arrows, keeping the two surfaces perfectly in contact. The burr is cut off in this way. If any at all exists it may be felt by passing the finger over the edge of the tool.

Put the oil stone away immediately the above operation is completed so that it may be kept free from grit and dust. Now take back iron in left hand and plane iron in right, holding them both horizontally as shown in diagram 46.

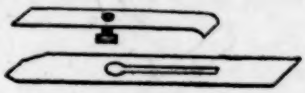


Fig. 46.

Be careful to have the head of the screw directly over the circular hole in the plane iron. Now slide the upper iron along until about $\frac{1}{16}$ in. from the edge of the plane iron. Hold both horizontally in left hand and screw up with right.

Be careful not to let the irons move in screwing. When the irons are as tight as the thumb and finger can screw them put the two upon the bench with screw upwards, and now tighten this by using the driver.

When the two are set it is sometimes found that they have moved a little in screwing. This may be remedied by the hammer as follows: gently strike the irons on the side as shown by arrows in diagram 47.

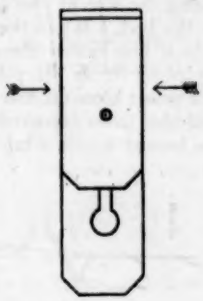


Fig. 47.

Suppose we find the two edges are too near and we wish to bring them further apart without unscrewing. Strike gently at point A as shown in diagram 48.

Fig. 48.

If, on the other hand, we wish to have them nearer we tap the screw-head in direction of arrow shown in diagram 48 at B. It is best to let the side of the hammer rest entirely on the iron while tapping the screw. This tapping causes the edge of back iron to be brought nearer to the edge of cutting iron.

Now we proceed to set the plane up. Take the irons in right hand and stock of the plane in the left having the thumb in the throat of it and the 4 fingers on the sole. Place the plane on the bench as shown in diagram 49.

Fig. 49.

It will be observed the bed of the irons is now horizontal with bench. Slide in the irons and put the thumb now upon them to keep them in position. Now bring the plane over as shown in diagram 50.

Fig. 50.

Pass the eye along the sole of the plane and push down the irons in the bed. When they appear at the mouth as a thin black line fasten them in by getting the wedge and placing it in its position. Get a hammer and give a smart blow on the wedge (not two or three taps) and the irons are fixed. If the irons are required to be loosed again, a tap in direction of arrow, diagram 51,

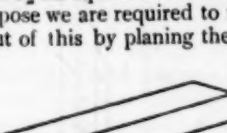


Fig. 51.

will instantly loosen them again. They can then be set up at will.

Exercise XII.

We will now take the block we squared in exercise XI., and which is 1½ in. square in end section, and say 12 in. long. Suppose we are required to make another squared block out of this by planing the part shaded in diagram 52.

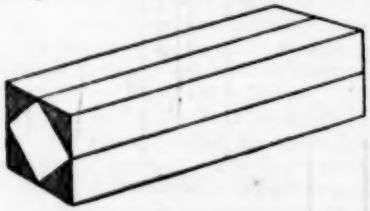


Fig. 52.

We shall require the gauge first thing. If the side be 1½ in. then ⅝ of this is ¾ in. Set the gauge to ¾ in. and run down lines on the face side and edge, and on the two sides opposite. Now we want something to hold the block while we plane away parts required.

We have a simple contrivance known as a Bolster. Diagram 53 shows one.

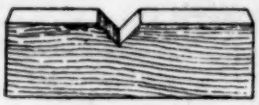


Fig. 53.

Put two of these under the piece and have the bench stop up sufficiently high. As the cutting in the bolster is a right angle we get our block held firmly. Plane down to the gauge lines not forgetting to go to the middle of the V-like impression made by spur.

(To be continued.)

—o—

Contracted Arithmetic.

BY J. L. RICHARDSON.

SECTION XIV.

Multiplication by 101 to 109.

Since 101, 102, 103, &c., represent one hundred plus one, two, or three, we have simply to annex two cyphers to the multiplicand, and add once, twice or thrice itself to the result.

Example:—4,238 × 105.

423,800. Multiplying by 100.
21,190. Five times 4,238.
444,990. Answer.

EXERCISE XVII.

1. 304 × 101.	2. 742 × 102.
3. 963 × 103.	4. 814 × 104.
5. 623 × 105.	6. 514 × 106.
7. 387 × 107.	8. 496 × 108.
9. 507 × 109.	10. 635 × 106.

SECTION XV.

Multiplication by 99, 999, &c.

As 99 and 999 are respectively just one less than a hundred and a thousand, we need only add to the multiplicand two cyphers, or three as the case may be, and subtract the original number from the result.

Example:—7,692 × 99.

769,200. 100 times the multiplicand.
7,692. Multiplicand once deducted.
761,508. Answer.

EXERCISE XVIII.

By 99.	1. 41,304.	2. 38,256.	3. 78,152.
	4. 60,484.	5. 924,810.	
By 999.	6. 198,260.	7. 54,285.	8. 60,235.
	9. 46,782.	10. 915,802.	

SECTION XVI.

Multiplication by 125 or 750.

As 125 is the eighth part of a thousand, add three cyphers to the multiplicand, and divide the result by 8.

And as three-fourths of a thousand are 750, we adopt a similar course to that of Section 13 with respect to 75, adding three cyphers to the multiplicand, and deducting one-fourth of the result.

Example:—9,825 × 750.

4)9,825,*000*. A thousand times the multiplicand.
2,456,250. One-fourth to deduct.
7,368,750. Answer.

EXERCISE XIX.

By 125. 1. 3,826. 2. 59,014. 3. 76,182.
4. 4,823. 5. 791,386.
By 750. 6. 5,623. 7. 93,765. 8. 291,706.
9. 35,825. 10. 643,125.

SECTION XVII.

Multipliers containing Multiples.

As multipliers often contain digits, or collections of such, which are multiples of each other, a little thought will suggest various ways of abridging the operations in which they appear. For instance, if the multiplier be 369 we see that 36 contains four nines. The sum 7,234 × 369 might therefore be worked thus: Multiply by nine, as usual, for the first line, then take four times 65,106 for the second line, which must commence under the second digit.

7,234
369
65106
260424
2,669,346

The digits of the multiplier might, however, appear in reverse order, as 963, in which case the multiplication must begin on the left with 9 × 4, the first digit of the line being placed under the nine in the multiplier. Then, as 63 contains seven nines, we take seven times the line just found, arranging the product so that the right hand digit shall appear under the corresponding figure of the multiplier.

The sum so worked would appear thus:—

7,234
963
65,106 (*a*) Nine hundred times the multiplicand.
455,742 Seven times (*a*).
6,966,342. Answer.

EXERCISE XX.

1. 345 × 324. 2. 526 × 954.
3. 637 × 756. 4. 759 × 872.
5. 861 × 927. 6. 496 × 630.
7. 836 × 428. 8. 493 × 540.
9. 728 × 642. 10. 913 × 721.
11. 719 × 405. 12. 328 × 366.
13. 457 × 182. 14. 563 × 204.
15. 671 × 459. 16. 317 × 153.
17. 426 × 637. 18. 789 × 328.
19. 496 × 279. 20. 743 × 426.

SECTION XVIII.

Multiplication by 115, 1,116, 11,117, &c.

When multipliers consist of a collection of ones followed by a single higher digit, multiply by the units figure, adding in as many right hand back figures as there are *ones* in the multiplier.

An alternative method would be to break up the multiplier into such combinations as are practicable, and proceed as in Section 8. Thus 115 would become 11 and 5; 1,116 might be taken as 11 and 16 (Section 10); 11,117 as 11 and 11 and 7, and so on.

Example:—82,765 × 1,114.

First take four fives, and, as there are no figures to the right of the 5, we put down a cypher. Then four sixes, with five on the right, and two carried, make 31, one down and three to carry. Four sevens, with three carried and the right hand figures six and five make 42. Two down and four to carry. Four twos, with four carried, and seven, six, and five, back figures, give 30, nought down and three to carry. Eight fours, with three carried and the back figures two, seven, and six make 50. Nought down and five to carry. We must now say four noughts, with five carried, and eight, two and seven, are 22. Two down and two to carry. Then four noughts, with two carried, and nought, eight and two make 12, two down and one to carry. Lastly, four noughts, with one carried, plus nought, nought, and eight make 9, the concluding figure of the answer 92,200,210.

EXERCISE XXI.

By 114. 1. 2,346. 2. 4,287. 3. 3,589.
4. 72,104. 5. 3,860.
By 1,115. 6. 6,243. 7. 7,482. 8. 5,983.
9. 42,701. 10. 6,428.
By 11,116. 11. 5,192. 12. 3,841. 13. 6,254.
14. 74,208. 15. 35,462.
By 111,117. 16. 2,839. 17. 4,823. 18. 56,190.
19. 47,180. 20. 23,971.

ANSWERS.

EXERCISE XVII.

1. 30,704. 2. 75,684. 3. 99,189. 4. 84,656.
5. 65,415. 6. 54,484. 7. 41,409. 8. 53,568.
9. 55,263. 10. 67,310.

EXERCISE XVIII.

1. 4,089,096. 2. 3,787,344. 3. 7,737,048.
4. 5,987,916. 5. 91,556,190. 6. 198,061,740.
7. 54,230,715. 8. 60,174,765. 9. 46,735,218.
10. 914,886,198.

EXERCISE XIX.

1. 478,250. 2. 501,804. 3. 9,522,750.
4. 602,875. 5. 98,923,250. 6. 4,217,250.
7. 70,323,750. 8. 218,779,500. 9. 26,868,750.
10. 482,343,750.

EXERCISE XX.

1. 111,780. 2. 311,004. 3. 481,572.
4. 661,848. 5. 798,147. 6. 312,480.
7. 357,808. 8. 266,220. 9. 467,376.
10. 658,273. 11. 291,195. 12. 120,048.
13. 83,174. 14. 114,852. 15. 307,989.
16. 48,501. 17. 271,362. 18. 258,792.
19. 138,384. 20. 316,518.

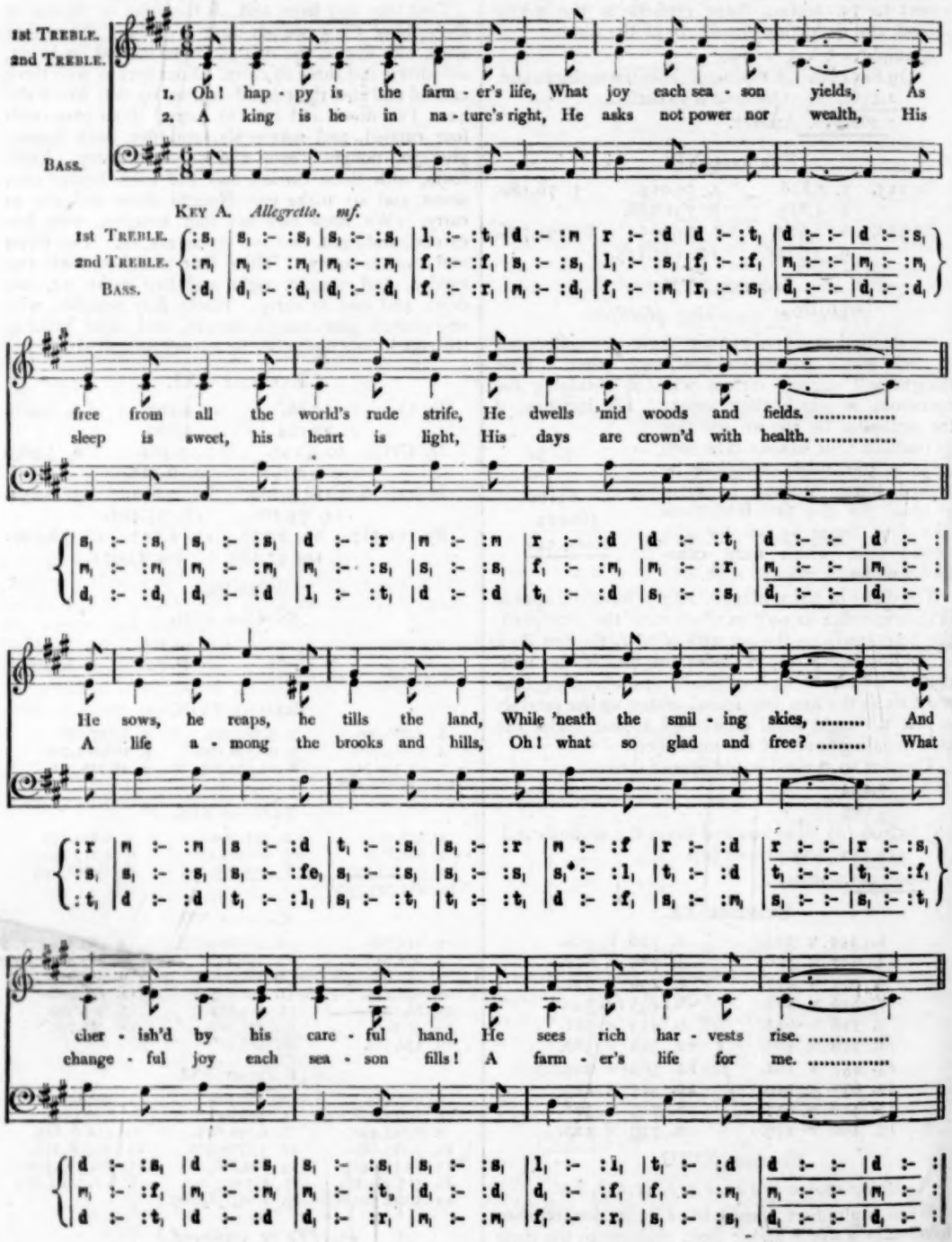
EXERCISE XXI.

1. 267,444. 2. 488,718. 3. 409,146.
4. 8,219,856. 5. 440,040. 6. 6,960,945.
7. 8,342,430. 8. 6,671,045. 9. 47,611,615.
10. 7,167,220. 11. 57,714,272. 12. 42,696,556.
13. 69,519,464. 14. 824,896,128. 15. 394,195,592.
16. 315,461,163. 17. 535,917,291. 18. 6,243,664,230.
19. 5,242,500,060. 20. 2,663,585,607.

(To be continued.)

THE FARMER'S LIFE.

Allegretto. mf. *Tune:*—'FRIAR BACON WALKS AGAIN.'


1st TREBLE.
2nd TREBLE.
BASS.
1. Oh! hap - py is the farm - er's life, What joy each sea - son yields, As
2. A king is he in na - ture's right, He asks not power nor wealth, His
KEY A. *Allegretto. mf.*
1st TREBLE.
2nd TREBLE.
BASS.
free from all the world's rude strife, He dwells 'mid woods and fields. .....
sleep is sweet, his heart is light, His days are crown'd with health. .....
He sows, he reaps, he tills the land, While 'neath the smil - ing skies, ... And
A life a - mong the brooks and hills, Oh! what so glad and free? ..... What
cher - ish'd by his care - ful hand, He sees rich har - vests rise. .....
change - ful joy each sea - son fills! A farm - er's life for me. .....

Practical Kindergarten Lessons for English Elementary Schools.

BY MRS. MORTIMER.

Lecturer at the Home and Colonial Training College.

XVI.

GIFT XV.

EXAMPLES OF LESSONS.—SLATS FOR INTERLACING.

THESE slats, or laths as they are sometimes called, are about 10 inches long, $\frac{3}{8}$ of an inch wide, and $\frac{1}{16}$ of an inch thick. They are made of birch or other tough wood. Many geometrical figures can easily be made by using a few of these laths.

This and the two following gifts belong to the group of edges, though really they form, as it were, the transition from the plane of the tablet to the edge of the staff. They differ, however, from both, for whereas the forms produced by the former, viz., tablets and staffs, were only laid on the table, the forms made with these can be raised from the table. The child first receives one slat, and on examining it he perceives that it is long, thin, narrow, oblong, and flexible; that it is made of wood; and has two long flat sides, two narrow sides, or edges as he will call them, and two ends. The child must now learn to point quickly and accurately to its different parts, its upper and lower sides, its top and bottom ends, its right and left edges, and its centre. He should also name any objects similar to the slat, *e.g.*, flat rulers, frames of slates, planks of wood, laths used in building, etc. He should now be required to place the slat in all the different positions he can, thus, perpendicular, horizontal, and oblique, from left to right and from right to left.

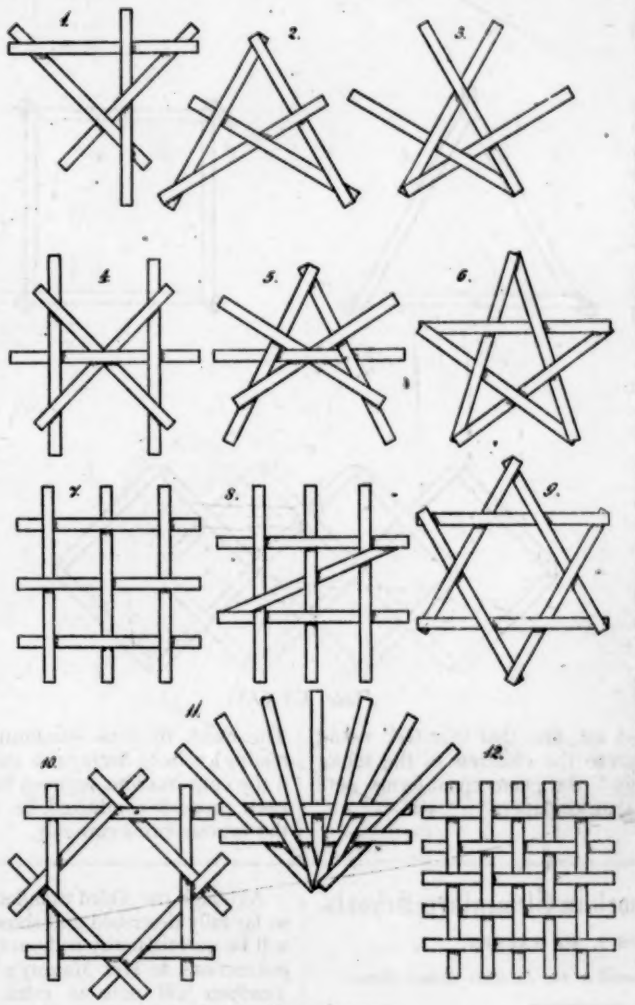


Plate XXXVIII.

A second slat is then given; it is compared with the first, and is found to correspond exactly with it. The two are then placed in different positions. Parallels, and all the different angles can now be formed.

A third slat is then given, and the same exercises are continued, the triangle being produced.

So far, this occupation is similar to that of stick-laying, the work being to examine, describe, compare, and lay in different positions.

It is not until the fourth slat is given that the children are able to make anything that will hold together—that can be raised from the table. In order to do this, each slat must come in contact with at least three others.

Several forms can be plaited with four laths; when made, each form must be talked about. The different kinds of lines, angles, and figures must be named and described. Additional slats to be given at the discretion of the teacher. In every case the form is to be fully described. For example, the first form has eight right angles, eight acute, and eight obtuse angles, two triangles, and one trapezium. Plate XXXVIII., No. 1. It will be seen from this that *Form* is the principal element introduced into this occupation.

The laths need very careful handling, for if one slips out of its place the whole work falls to pieces.

The laths should be plaited on the table, the left hand being spread out to cover, as far as possible, the whole of the form, thus holding the slats in their places, while the right hand is employed putting the slats together.

GIFT XVI.

THE SLAT WITH MANY LIMBS OR THE JOINTED LATH.

THESE slats are about the same width and thickness as those of Gift XV., and are made in lengths of four inches. These lengths are joined together, and can be either opened or closed. The jointed lath varies as to the number of its links or joints consisting of 4, 6, 8, 12, and 16. The simple ones are first used, the others gradually following. They are used to represent various lines, angles, figures, and letters.

When the smallest jointed lath is given to the children, they should be shown how to open it so as to form a straight line, and place it perpendicularly, horizontally, and obliquely. The various angles should be represented, named, and described. After these should follow triangles, squares, oblongs, pentagons, etc. Teachers will notice that the jointed lath is simpler than Gift XV., as there is no plaiting to do, and for this reason it might be introduced much sooner.

It will be seen that geometrical exercises are specially provided for, and that this Gift would give useful occupation to the children in the senior departments, especially if the geometrical forms were afterwards drawn on slate or paper.

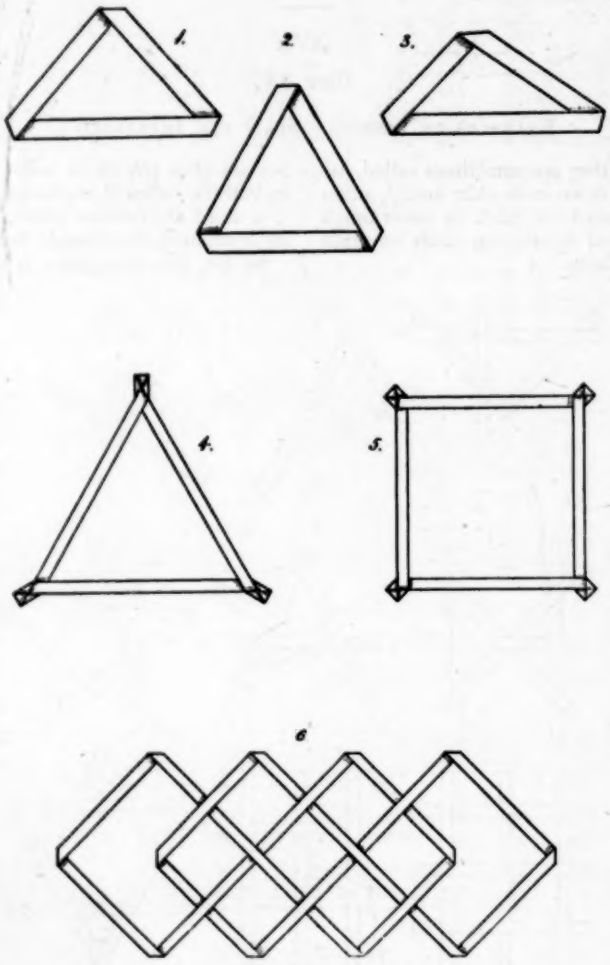


Plate XXXIX.

GIFT XVII.

MATERIAL FOR INTERTWINING.—Plate XXXIX.

THIS Gift is similar to that of interlacing, but here permanent results are produced. The material consists of slips of white or coloured paper, 8 or 10 inches long, and $\frac{3}{4}$ of an inch wide. These strips are folded into three, thus making them $\frac{1}{4}$ of an inch wide, and three fold. Each child has at first one of these strips, and when he has folded it he places it in different positions, viz., perpendicular, horizontal, and oblique; after this he twists the strip into various forms.

The different kinds of angles should be made first, then triangles, squares, oblongs, etc. Where the paper is folded it must be well pressed down, and the ends of the paper pasted together.

Any very neat work should be mounted on cardboard.

By means of this occupation the children acquire great deftness and neatness of hand.

In making the various forms accurately their eyes become accustomed to measuring distances.

It will be noticed that, like the preceding gifts, this one still further impresses on the child the different geometrical terms. The child, by thus constantly making these forms, readily learns to distinguish them from each other, and if the conversations between him and the teacher have been properly conducted, he will be able to describe the various forms correctly.

Practical Needlework in Elementary Schools.

BY MISS J. W. WARREN,

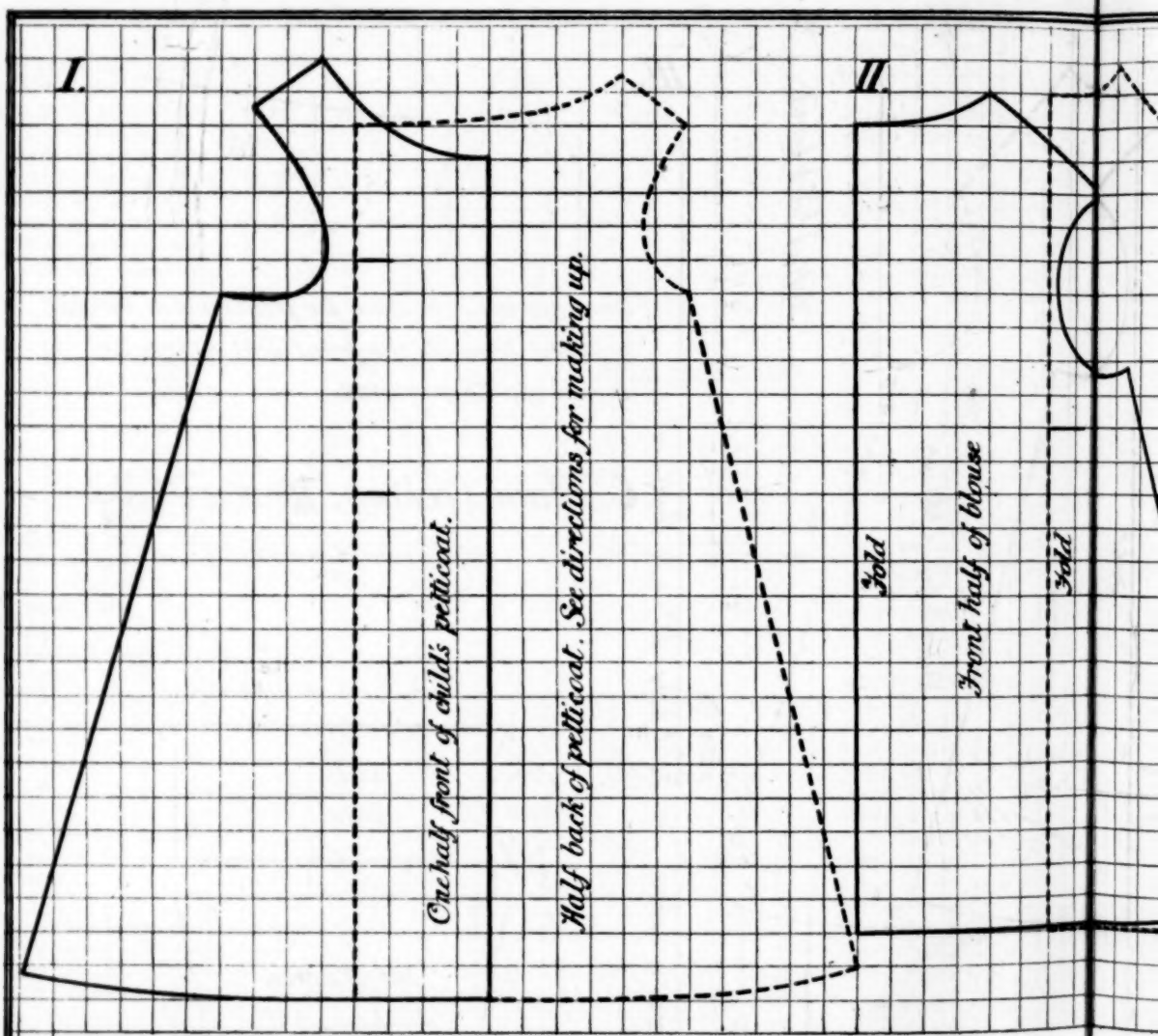
Inspectress of Needlework to the Leicester School Board.

BEFORE proceeding with my paper, it will be as well to remark that since the last article was written the New Code has reached us, and the few slight differences beginning in the Third Standard will be now and hereafter noted. These articles will, therefore, be to all intents and purposes quite up to date.

Although the Third Standard specimens have been so far fully described and shown, I feel that this paper will be unsatisfactory without the addition given in the instructions to Her Majesty's Inspectors, just issued. Teachers will note an extra specimen, D, which is simply A of Standard II., with the extra exercise of *fixing a hem*.

It will be noted that the instructions are for calico in this specimen. Holland would have been far more suitable, being easier to fix and to work, and nearer to the garments which in this and lower Standards are made frequently of this material. I will give two

BRITISH
31 MY 90
MUSEUM



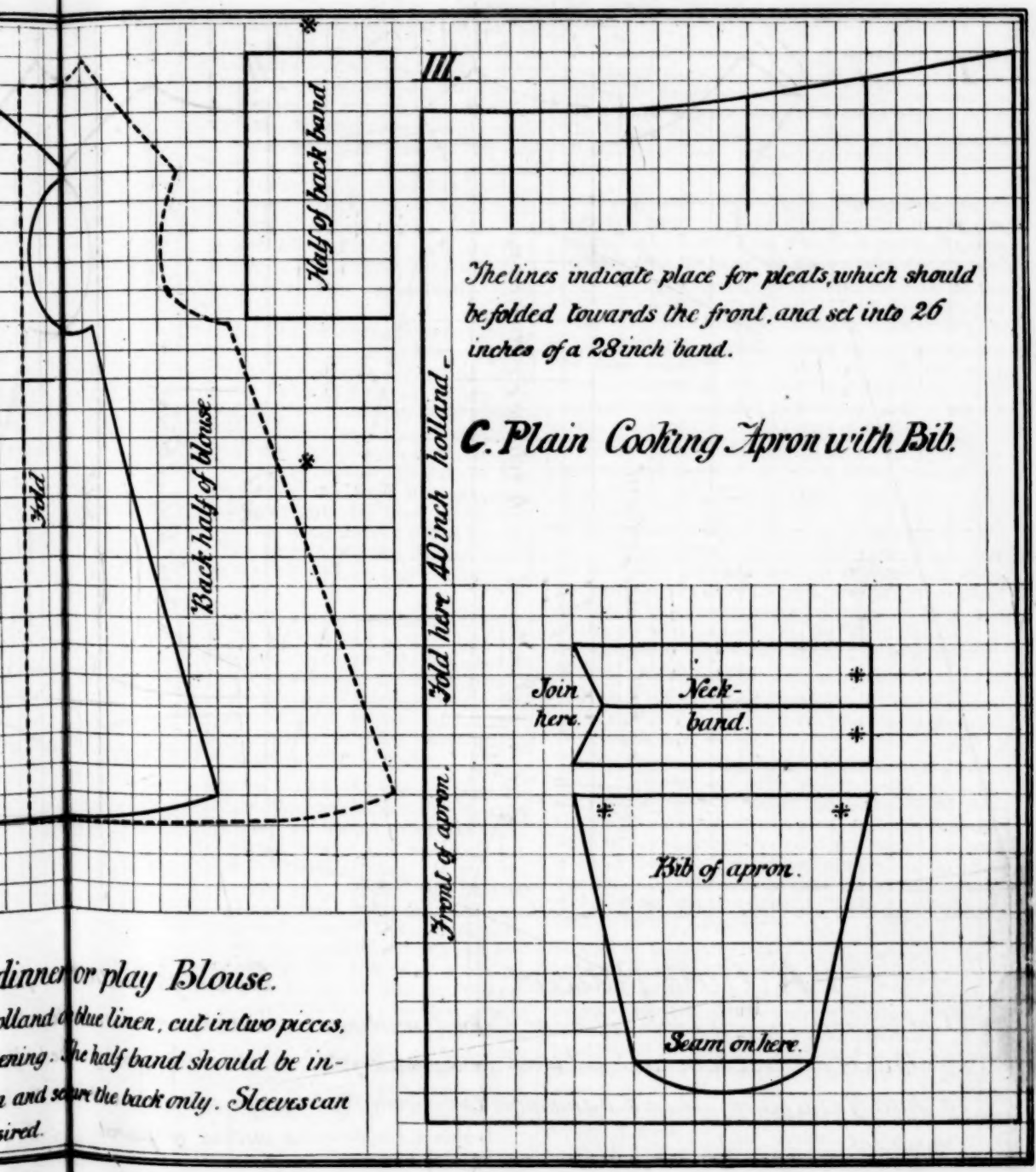
A. Girl's Petticoat.

Can be made in stout white calico or Oxford shirting, admits of a broad hem and full pleat in the back, fits a child of nine years. Should hang quite loose from the shoulders.

B. Boy's dinner or pla

Made up in holland o blue lin slit for back opening. The half -serted side seam and sew the b be put in if desired.

III.



The lines indicate place for pleats, which should be folded towards the front, and set into 26 inches of a 28 inch band.

C. Plain Cooking Apron with Bib.

dinner or play Blouse.

lland of blue linen, cut in two pieces, ening. The half band should be in- and sewn the back only. Sleeves can ired.

methods of preparing this specimen, though there is little doubt it is intended to test the children's skill in fixing a handkerchief or pinafore, or some straight hem equally simple.

Mode.—Teach if possible on a coarse holland; proceed exactly as in Standard II. for the sew and fell. Now be careful to fix the hem in pairs, beginning with those running parallel with the sew and fell. The width of hem should be about one-third of an inch and *the same all round*, or else the two other sides wider; either is correct, but, for the sake of uniformity, it will be better to treat the piece fixed as a pocket handkerchief. Having folded and carefully pressed up the hem on each side, have the top now prepared, and after that the bottom. The actual tacking should be done last to avoid four joinings. When this is quite ready to tack, have it begun at the centre of the left side when held towards you. The corners and sew and fell can then be made firm by a back stitch, which should be made by the needle held in a vertical direction to avoid displacement. There should be no knot.

Another plan can, and doubtless will, be followed by some teachers, namely, to fix the whole specimen windmill fashion, one hem after the other, and *not in opposites*. This will be equally correct for a pocket handkerchief or square, but for nearly every garment the other plan only is correct, and indeed I should go further still and say that this specimen might be made to represent garments by making the bottom hem wider still. I do not urge this, but I distinctly recommend fixing by opposites, and care must be taken to do the *sides* first, or the whole exercise will be quite incorrect. I need not, perhaps, add that the hem should correspond with sew and fell, as regards right and wrong side.

The patterns given this month are intended for the Third Standard, but not restricted to it. The first is that of a girl's loose petticoat (marked A), and I cannot too strongly recommend this useful and simple garment for introduction into schools and amongst the parents; it entirely does away with the ordinary banded skirt, and introduces the weight from the shoulders, as recommended so largely now by all doctors.

Mode of making up. Cut the front in one piece, the back in two, join the backs and front by the ordinary sew and fell seam, from the bottom, join backs fifteen inches up, make a broad hem on each side of placket, and to correspond a box pleat, which will give the necessary fulness at the back. A small tape must be hemmed in at the point where placket ends and pleat begins, to strengthen and secure it. Now join shoulder pieces, and make neat the arm holes and neck by a one-inch width of material on the cross sewn at the top of neck, hemmed at the bottom of same, into this run a narrow tape; one more tape four inches down secures the placket and back. The bottom of the petticoat is made neat by a two-inch width hem. Care in fixing this is needed, but all the work of the garment can be done in the Third Standard, with careful supervision.

Flanellette, unbleached calico, or soft galatea, will then be found suitable; a 7 needle and 36 cotton.

Note.—For those who like children's clothing to be tight, this little pattern is of no use, it is intended to hang quite easy from the shoulders; the one from which the pattern is taken has been worn all last summer by a girl of nine years, with all possible comfort and freedom of movements.

If greater security is needed, a hemmed tape, somewhat below the waist, can be added, into which a narrower piece should be run. The pattern allows for the turnings required in the mode of making up suggested.

The second pattern, marked B, represents a blouse, and though marked for a boy, will do equally well for a girl. It should be cut from holland, blue linen, or soft shirting of some kind; it is never wise to cut a play blouse from print. The sleeves are not given, these differ so much, and are not needed for a boy in frocks.

Mode of making up. Cut the blouse in *two pieces*, back and front, join sides and shoulders by sew fell-seams. Now from the top of the back, one inch nearer left side than the right, slit the material down to the mark indicated in diagram (10 inches), finish off the back with a *broad* on left and narrow hem on right side. The neck band as in pinafore with a draw tape.

Notice that this overall is large in front, and should be loose there, though drawn up to fit the child high in the throat. The half-band should be neatly seamed to the sides and buttoned at back, it will be found to secure the proper fitting of the front.

I have given in this pattern an exceedingly plain garment, and imagined that it is to be put over a better pinafore for meals, or over a boy's suit for play. The length, therefore, will appear out of proportion until it is remembered that it is intended completely to hide all under garments. The shoulder slope is a fit, but an exact fit of any child must be expected only when the slide is drawn up by the tape. No button nor other fasten will be necessary at back than that of band, but if the garment is made in the Third Standard, a hemmed piece, long enough to tie, may be substituted to avoid the button-hole.

Plain Cooking Apron, marked C. The diagram shows only half the apron, as do also the diagrams of the Petticoat and Blouse.

I feel that it is perhaps a little superfluous to give so simple a pattern, but while we are having so many fancy cooking aprons brought into use by the different schools of cookery, it may be a relief to turn from the different sloped articles to a good old English pattern. A slim woman can wear a gored pattern, but when the hips are large nothing is so good for downright hard wear as some fulness, it admits of rubbing, and adapts itself better to the figure.

Mode of making up. Buy a forty inch stout dark brown holland (not the glassy-surfaced holland) one inch hem at the bottom, slope the top as given in diagram, put three quarter inch pleats falling forwards. When pleated, the top should measure 26 inches. The band should be hemmed on right and wrong side, and should not in width measure more than two inches when finished. The waist measure should be 28 or 29 inches, and should be finished with tapes, which should be tied in front.

The bib, finish with a narrow hem all round, seam on to band, leaving curved piece over band. The neck-band should also be hemmed round; it will be seen that it is in two pieces, and should be joined not

only at the points starred, but at the back, where the small gore will enable it to fit round the shoulders, and be slipped over the head. A pocket can be added, and should then be fixed into the band. The work is quite within the compass of the Third Standard.

It will be noticed that no fine work is given for this Standard, each garment and specimen is sufficiently coarse to fulfil the most recent note in regard to both stitch and material.

In looking over Schedule III., 1890, I notice, and should like to call my readers, attention to the introduction there of *pleating*. This will certainly lead to the adoption of small pleats in the chemise, as suggested in my paper of March. This Standard's work has now been reviewed, and I purpose next month to deal with, and if possible give full specimens of that of the Fourth Standard. Many will be glad to see that some diminution of the work has been made by the leaving out of the marking.

—o—

Quarterly Arithmetical Tests.

BY JOSEPH WOLLMAN,

Head Master of the Wellgate Board School, Rotherham.

STANDARD I.—FIRST QUARTER.

1. 7, 240, 16, 9, 583

2. 780 − 250

3. 956 − 154

4. A boy had 59 marbles, and he bought two dozen. How many had he then?

SECOND QUARTER.

1. 95, 8, 706, 42, 467

2. 507 − 13

3. 685 − 678

4. A boy had 34 nuts in one pocket, and 16 less in another pocket. How many had he in both pockets?

THIRD QUARTER.

1. 829, 675, 34, 6, 951

2. 915 − 827

3. 304 − 6

4. A butcher bought 40 sheep. He killed 28, and sold five. How many had he left?

STANDARD II.—FIRST QUARTER.

1. Multiply 45,789 by 26.

2. Find the difference between 57,416 and 96,205.

3. 7,593 + 38 + 69,485 + 960 + 14,014 + 8,376.

4. When was a boy born who is 12 years old in 1890?

SECOND QUARTER.

1. Subtract 9,704 from 40,501.

2. Find the product of 18,690 and 718.

3. Divide 58,842 by six, and write the answer in words.

4. How many must be added to 39 times 785 to make forty thousand?

THIRD QUARTER.

1. Multiply 7,658 by 4,950.

2. Divide 14,079 by eight.

3. How much less is 36,518 than 81,563?

4. A wheel turns round 946 times in an hour; how often will it turn in 18 days, if it is in motion 7 hours daily?

STANDARD III.—FIRST QUARTER.

1. How many times is 38 contained in 18,088?

2. Divide three-quarters of a million by 694.

3. What number multiplied by 517 will give 356,730?

4. Divide 313,752 by 408, and multiply the quotient by 590.

SECOND QUARTER.

1. Subtract 18s. 7¼d. from ten pounds ten shillings and tenpence three-farthings.

2. £5 18s. 7¾d. + £48 16s. 11½d. + £827 19s. 8¼d. + £3,456 12s. 9¾d. + £783 10s. 6d. + £95 14s. 5½d. + £8 17s. 10¼d.

3. How many pages will be occupied by 94,944 words, if there are 46 lines on each page and eight words in a line?

4. If I spend £4 16s. 9d. and £3 17s. 5d. out of £10, how much have I left?

THIRD QUARTER.

1. Find the sum of £5,618 13s. 7¼d., £265 18s. 9½d., £19,074 11s. 10¾d., £89 15s. 4½d., £7,950 6s. 11d., £34,812 14s. 8¾d., and £537 9s. 2½d.

2. What is the least number that must be taken from a million, so that the remainder may be exactly divisible by 589?

3. How much is £2,964 10s. 7¼d. greater than £987 13s. 9½d.?

4. A suit of clothes cost two guineas and a half. The trousers cost 19s. 6d., and the vest 10s. 9d.; what was the cost of the coat?

STANDARD IV.—FIRST QUARTER.

1. £2,579 15s. 10¾d. × 59.

2. Divide £28,937 16s. 6d. by 476.

3. How much would a mason earn in a week if he earned 10½d. an hour, and he worked nine hours a day for the first five days and five hours on Saturday?

4. A shopkeeper bought 354 books for £67 2s. 3d., and sold them at 4s. 6d. each. How much did he gain on each book?

SECOND QUARTER.

1. Bring seventeen thousand and ninety-five inches to chains, &c.

2. How many threepences are equal to 5,876 guineas?

3. Reduce a quarter of a ton to half-ounces.

4. What will it cost fencing a field 1¼ miles round at 2½d. per yard?

THIRD QUARTER.

1. If a man drinks half a pint of ale a day, how many gallons, &c., will he drink in a year?

2. How many minutes are there from nine o'clock on Monday morning to five o'clock on Friday afternoon?

3. Reduce 814,070,304 square feet to square miles, acres, and square yards.

4. If a boy saves 1½d. a day, how many weeks will it take him to save three guineas and a half?

STANDARD V.—FIRST QUARTER.

1. Find the value of 5,793 articles at £16 14s. 9¾d. each.

2. What is the cost of 17 tons 12 cwt. 3 qrs. at £11 13s. 4d. per ton?

3. If a tax of 5d. in the £ is paid on an income of 700 guineas, how much is left?

4. What is the value of 5 sq. miles 405 ac. 2 ro. at £1,769 6s. 8d. per square mile?

SECOND QUARTER.

1. A train goes through a tunnel 5,940 yards long in 4½ minutes; at what rate per hour is it travelling?

2. How much does a creditor receive in payment for a debt of £978 15s., if the debtor pay 8s. 6d. in the pound?

3. How long will a field, which has pasture for nine score sheep for 9½ days, graze four score and 15 sheep?

4. Make a bill for:—

325 articles at 11s. 6d. per hundred;
79½ stone at 3s. 5d. per stone;
700 lbs. at 9½d. per lb.;
192 articles at 18s. per gross;
91 lbs. at 4s. 9d. per stone.

THIRD QUARTER.

1. A peal of five bells ring at intervals of 6, 9, 15, 24, and 30 seconds. At what intervals will they toll together?

2. Reduce $\frac{3}{8}$, $\frac{10}{12}$, and $\frac{15}{20}$ to equivalent fractions, each having 24 for the denominator.

3. What is the sum of $\frac{5}{6}$ of a pound and $\frac{5}{6}$ of a crown?

4. I spend 24 guineas in 70 days, and save £200 a year; what is my income?

STANDARD VI.—FIRST QUARTER.

1. Divide the sum of $\frac{11}{12}$ and $\frac{13}{16}$ by their difference.

2. Divide 9·78 by 600, and multiply the quotient by ·0095.

3. Simplify:—

$$\frac{5\frac{1}{2}}{\frac{33}{40}} \div 7.$$

4. The product of two numbers is ·00493, and one of the numbers is ·058. Find the sum of the two numbers.

SECOND QUARTER.

1. If $\frac{3}{8}$ of an estate is worth £1,066 13s. 4d., what is the value of ·46 of it?

2. What decimal of $\frac{3}{5}$ of a crown is $\frac{7}{8}$ of a guinea?

3. A man commenced work on the morning of March 1st, and left on the evening of July 24th. What salary was due to him at the rate of £144 a year?

4. A man has a garden with five kinds of trees in it. Of these $\frac{1}{5}$ are apple, $\frac{3}{8}$ pear, $\frac{1}{10}$ plum, and $\frac{3}{15}$ cherry trees, and there are 46 which are not fruit trees. How many trees are there altogether in the garden?

THIRD QUARTER.

1. I bought $\frac{7}{8}$ of a yard of silk for 5s. 6½d.; how much should I pay for 19¾ yards?

2. Find the amount of £798 8s. 9d. in 57 days at 4 per cent.

3. Divide half-a-guinea among three persons, giving the second four times as much as the first, and the third four times as much as the second.

4. In what time will £750 amount to £766 17s. 6d. at 3 per cent.?

STANDARD VII.—FIRST QUARTER.

1. A man walks 250 miles in 10 days, walking 8 hours a day. How long will it take him to walk 739,200 yards, walking 7 hours a day?

2. A can plough a field in 2½ days, and B can plough it in 2⅓ days. How long would it take them working together?

3. What should be the rent of 29·8̇3 ac. for 5½ years, if the rent of 12·75 ac. for 3 years is £133·875?

4. At what rate per cent. will £640 amount to £718 8s. in 3½ years?

SECOND QUARTER.

1. I bought 360 oranges at 8d. per dozen, 420 at 6d. per dozen, and 300 at 9d. per dozen. What was the average price per score?

2. Two persons, A and B, gained in trade £618 15s. A put £2,250 into the business, and B put £1,875; what was their respective shares of the profit?

3. Find the average of the following fractions:—
$\frac{1}{3}$, $\frac{1}{7}$, $\frac{1}{9}$, $\frac{1}{11}$, $\frac{1}{13}$.

4. A sum of money is lent at 4 per cent. simple interest. How long will it take to gain ·75 of the principal?

THIRD QUARTER.

1. By selling beer at 2¼d. per pint a publican gains 25 per cent. What does it cost him per gallon?

2. If the interest on a sum of money be £12 1s. 6d. more at 6¼ per cent. than at 4½ per cent., what is the sum?

3. A village contained 478 males and 722 females; what was the percentage of each?

4. By selling an article for £3 10s. 6d. the dealer lost 6 per cent. What would he have gained or lost per cent. by selling it for £4?

ANSWERS.

STANDARD I.

	FIRST.	SECOND.	THIRD.
1.	855.	1,318.	2,495.
2.	530.	494.	88.
3.	802.	7.	298.
4.	83 marbles.	52 nuts.	7 sheep.

STANDARD II.

	FIRST.	SECOND.	THIRD.
1.	1,190,514.	30,797.	37,907,100.
2.	38,789.	13,419,420.	1,759 + 7.
3.	100,466.	9,807.	45,045.
4.	1878.	9,385.	119,196 times.

STANDARD III.

	FIRST.	SECOND.	THIRD.
1.	476 times.	£9 12s. 3½d.	£68,349 10s. 6½d.
2.	1,080 + 480.	£5,227 10s. 11d.	467.
3.	690.	258 pages.	£1,976 16s. 9¾d.
4.	453,710.	£1 5s. 10d.	£1 2s. 3d.

STANDARD IV.

	FIRST.	SECOND.
1.	£152,207 17s. 10½d.	21 chains 12 yds. 2 ft. 7 in.
2.	£60 15s. 10½d.	493,584 threepences.
3.	£2 3s. 9d.	17,920 ozs.
4.	8½d.	£22 18s. 4d.

THIRD.

1. 22 gals. 3 qts. ½ pt. 3. 29 sq. mls. 128 ac. 2,336 sq. yds.
2. 6,240 minutes. 4. 84 weeks.

STANDARD V.—FIRST.

1. £96,978 8s. 9¾d. 3. £719 13s. 9d.
2. £205 15s. 5d. 4. £8,967 14s. 1¼d.

SECOND.

1. 45 miles.
2. £415 19s. 4½d.
3. 18 days.
4. £1 17s. 4½d. + £13 11s. 7½d. + £27 14s. 2d. + £1 4s. + £1 10s. 10½d. = £45 18s. 0½d.

THIRD.

1. 6 minutes. 3. £1 0s. 10d.
2. $\frac{8}{11}$, $\frac{11}{12}$, $\frac{12}{13}$. 4. £331 8s.

STANDARD VI.

	FIRST.	SECOND.	THIRD.
1.	$5\frac{1}{4}$.	£1,120.	£6 5s. 1d.
2.	·00015485.	5·5125.	£803 8s. 6d.
3.	$\frac{11}{12}$.	£57 12s.	6d., 2s., and 8s.
4.	·143.	240 trees.	9 months.

STANDARD VII.

	FIRST.	SECOND.	THIRD
1.	19½ days.	1s. 0½d.	£2 8s.
2.	$1\frac{1}{10}$ days.	A, £337 10s. B, £281 5s.	£690.
3.	£574 5s. 10d.	$\frac{3000}{11111}$.	Males, 39⅔ per cent. Females, 60⅓ p. cent.
4.	3½ per cent.	18¾ years.	6⅔ per cent. gain.

A Paper on Paraphrasing.

BY C. J. DAWSON, B.A.,

Author of Essays and Essay-writing.

To paraphrase a passage of poetry or prose is frequently required of candidates at examinations in English as an exercise in composition. This fact, apart from any other consideration, makes it necessary that students preparing for examination should acquire some skill in the art of paraphrasing. As a first step towards this end it is desirable that clear ideas should be formed of the nature and purpose of the exercise; and, if it is possible to acquire also a conviction that the art and practice has a value of its own, the end may be reached the more pleasantly and the more speedily. The need for considering this question appears from the fact that much difference of opinion has prevailed among writers on education as to the worth of paraphrasing, and this divergence of opinion seems traceable in great measure to a want of agreement as to the exact nature of paraphrasing, and mistaken notions as to its object.

What, then, is Paraphrase? Perhaps no better or more comprehensive definition of the term can be given than one to be found in an able article which appeared nearly thirty years ago in an educational periodical called *The Museum*. '*PARAPHRASE is the translating of an author's thought out of the FORM in which he has expressed it into a NEW FORM.*' The new form of expression may differ from the original in greater or less degree; but there are some modes of effecting change which do not deserve to be regarded as paraphrase, but which need rather to be distinguished from it. The simplest of these consists in re-writing the passage in natural prose order, and so freeing it from those inversions and elliptical constructions which are common in poetry and some kinds of rhetorical prose. This has been called *Transposition*, or literal prose translation. It is a useful exercise in grammar, and is helpful especially in parsing and analysis. It may also very properly form a first step for beginners in paraphrasing. The following examples will illustrate this exercise. The first is from the introduction to Scott's *Marmion*.

> 'No longer Autumn's glowing red
> Upon our Forest hills is shed;
> No more, beneath the evening beam,
> Fair Tweed reflects their purple gleam;
> Away hath passed the heather-bell
> That bloomed so rich on Needpath-fell;
> Sallow his brow, and russet bare
> Are now the sister-heights of Yair.'

In plain prose this would be arranged thus:—

'Autumn's glowing red is no longer shed upon our forest hills; fair Tweed no more reflects their purple gleam beneath the evening beam; the heather-bell, that bloomed so rich on Needpath-fell, hath passed away; his brow (is) sallow, and the sister-heights of Yair are now russet (and) bare.'

> 'Thrice is he arm'd who hath his quarrel just,
> And he but naked, though lock'd up in steel,
> Whose conscience with injustice is corrupted.'

This extract from Shakespeare becomes—

'He who hath his quarrel just is thrice armed, and he whose conscience is corrupted with injustice (is) but naked, though he be locked up in steel.'

Another process which needs to be distinguished from true paraphrase, for which it is too often mistaken, is the simple changing of words in a passage for others which are, or are supposed to be, synonymous. This has been well named *Substitution*; but a writer who appears to think it an exercise worth practising calls it *Synonymic Paraphrasing*. Ar a sample of what it is we take four lines from the opening of Pope's '*Essay on Criticism*,' and give Mr. Samuel Neil's equivalent for them:—

> 'Tis hard to say if greater want of skill
> Appear in writing or in judging ill;
> But, of the two, less dangerous is the offence
> To tire our patience, than mislead our sense.'

Synonymic Paraphrase:—'It is difficult to say whether a more remarkable want of culture and ability is shown in composing or in criticising ill; but of the two, the fault of fatiguing our powers of endurance is less hurtful in its tendency than to deceive our intellect."

Such an exercise as this we hold has no right to be called paraphrasing. Neither has it any value worth considering. It may, indeed, be positively mischievous, as, for example when it leads to such interpretations as have been recently mentioned by Her Majesty's Inspectors in reporting on the Examination for admission to Training Colleges. The line 'There is in souls a sympathy with sounds' was, we are told, variously rendered as follows:—

'In the inner part of man there is a sort of desire for sounds.' 'In spirits there is pity with vibrations.' 'In souls there is a feeling with symphonies.'

The late Mr. Matthew Arnold, commenting on this style of paraphrasing, records that this line, descriptive of the Indian Chief Oneyda in Campbell's *Gertrude of Wyoming*,—

'As monumental bronze unchanged his look,' was rendered by one candidate, 'His demeanour was unchangeable as ornamental ironwork;' while another candidate wrote, 'His countenance was fixed as though it had been a memorial of copper and zinc.'

To the mistaken view of paraphrasing which leads to these absurdities is undoubtedly due in great measure the common complaint of examiners that 'the paraphrase is seldom well done;' or 'the weakest point was certainly the paraphrase;' or 'paraphrasing was the least satisfactory part of the work.'

To the same cause may probably be attributed the doubt which many writers have expressed as to the value of paraphrase. It is not unfrequently said of a piece of literary composition represented as perfect, that you cannot displace a word without spoiling the whole. Coleridge says, 'You may as well attempt to push a brick out of a wall with your forefinger, as push out a word from a passage of Shakespeare or Milton. *Your* word may be a very good word, but it is not *the* word.' Such remarks as these, allowing for a little rhetorical exaggeration, may be true enough; but when used as arguments against the use of paraphrasing they are beside the mark. Archbishop Trench taught us how few are the perfect synonyms in our language, and how strong is the tendency for words of similar meaning to become desynonymised or differentiated in their application. But paraphrasing is not a matter of mere synonyms. We must take a larger view of its scope. It is a means of representing the same ideas in an entirely different way. A good paraphrase will employ, if necessary, all the available means of variation in form and language. Words may be substituted, their order changed, phrases altered, figures of speech explained, suppressed, or changed, the whole expression may be recast. All that is essential is, that the thought expressed in the paraphrase shall be as nearly as possible the thought contained in the original.

It is not, of course, a necessary part of the critic's task to show how work might be freed from the faults he points out. Otherwise we might have expected the inspectors, from whose reports we have quoted, to state what they would have substituted for the absurd sentences they found. We will endeavour to supply the omission. For 'As monumental bronze unchanged his look,' the sentence, 'His countenance, statue-like, showed no emotion,' might have been allowed to pass; and 'Man's nature readily responds to strains of music,' or 'There is a natural correspondence between sounds and human feelings' might have been accepted for 'There is in souls a sympathy with sounds.' Still it might very properly be said that, though these sentences represent the original very fairly, they are by no means as perfect in the form of expression.

This brings us to the most serious mistake made by those who object to paraphrase as an exercise in composition. It is objected that the passage paraphrased is almost invariably spoilt—that is, the paraphrase is not as good as the original. Professor Bain, in his useful book '*On Teaching English*,' adopts this view. On the question of paraphrasing a piece of prose, he says, 'If the teacher cannot improve a passage he should leave it untouched, merely calling attention to the fact. If he can produce an equivalent of the same merit, so far well. If he can only degrade, he should do nothing.' Now the object of paraphrasing is not, ordinarily, to improve upon the original. As in the case of translation from a foreign language—and this is the exercise to which it is most perfectly analogous—its object is simply to represent the ideas of the original in another form. If done by the teacher for the pupil, it may be for the purpose of making it more readily understood, or it may be as a pattern for his imitation in some similar exercise. If the paraphrase is done by the pupil it is useful to the teacher, for it serves to test the pupil's intelligence, and proves whether or not he has a thorough grasp of the author's meaning.

The advantages the pupil may derive from practising this art of paraphrasing are many. The first is that it obliges him to pay close attention to the exact meaning of the original in its parts and as a whole. Then it exercises his power of expression and affords a means of training in the use of language. It makes him familiar with the very spirit of the literature he studies, and this should be of the best, and so it helps to cultivate his taste, and broaden and deepen his views.

The objection that paraphrasing results in the spoiling of fine passages is not only based on a mistaken idea of the object of paraphrase; it is also foolish, and in the most important sense untrue. The copy or version may be very inferior, but the original remains. As well might one say that children should not learn hand-writing or drawing from well-printed examples, because their own copies are clumsy, incorrect, and untidy. The incipient artist makes very imperfect studies and copies from the works of the great masters of painting and sculpture. But though he does not improve on the originals, he leaves them unmarred for others to imitate, while he rises on stepping stones of his own failures to a position much nearer the level of his high ideals than he would have done if he had made no attempts to understand and to imitate his exemplars.

The objection we have endeavoured to combat is not a new one. It may be traced back to Roger Ascham's famous book *The Scholemaster*, and again to some of the older writers on style to whom he refers It must be remembered, however, that Ascham used the term *paraphrase* in a rather different way. He

had another end in view; that end was the acquisition of a practical knowledge of the Latin language, and the process which he deprecated was the translation of passages from the Latin classics into equivalent or nearly equivalent Latin. He recommended, as a preferable plan of learning Latin composition, the method of translating a passage of Latin into English and then, after the lapse of some little time, re-translating the version into Latin, and finally comparing the result carefully with the original and marking every point of difference.

So far we trust we have done something to controvert the opinion that, because the result of attempts at paraphrase are often disappointing, the practice is therefore a useless one. To depreciate paraphrase on such a ground is analogous to the objection which some people make to the practice of learning and reciting passages of poetry, that some of the most beautiful pieces are apt to be mauled and mangled, and, forsooth, to become hackneyed. Mr. Matthew Arnold, who so strongly advocated the learning of poetry, and who did this also as tending to better results in regard to paraphrase by raising the standard of literary taste, had a more rational idea of the use of paraphrase. In the report already quoted, he says:

'It really seems to me that to paraphrase passably a few lines such as those from Campbell is as good a proof of general intelligence as any that could be required or given. To paraphrase them eminently well may be a proof of special faculty, and not necessarily indicative of a general intelligence of an eminent order. But to paraphrase them passably is at least a good negative proof, a proof that one's mind is not so poorly furnished and so dull of movement that one must be pronounced wanting in general intelligence.'

Paraphrase is sometimes divided into two kinds, the *Simple* and the *Florid*. In the first the aim is chiefly to express, as plainly and briefly as possible, the substance of the passage. This inclines towards summarising or précis-writing, which is a very useful practice, but is not really paraphrase, inasmuch as it seeks to state only the salient points of a passage instead of the whole meaning of the author. Florid paraphrase, on the other hand, allows of considerable expansion and development of the ideas; it tends, indeed, to become an exposition or theme dealing with the original as a kind of text to be illustrated. As an example, not an extreme one, of this kind of work we take the following from a recent work on Composition. The two lines

> 'What! art thou Virgil, thou that fountain bright
> Which pours of full clear eloquence the tide?"

are thus rendered. 'In a tone of wondering surprise and admiration the speaker asked if he were Virgil, the great Virgil, from whose brain and through whose lips had flowed, as from a fountain, that noble stream of immortal verse which had enriched many languages, and fertilised the minds of men in all ages and climes by the beauty and wisdom of its thoughts and words.'

However useful for practice in composition this exercise may be, we cannot commend it as a desirable form of paraphrase. We pass on rather to explain how two kinds of paraphrase may be recognised which we prefer to call *plain* and *free*.

In *plain* paraphrase, little change is made in the form of the passage, and the only additions allowed are such as are necessary to fill up ellipses. In *free* paraphrase there may be changes in the words employed, their order, the grammatical construction, the figures of speech used, and in short in the whole structure of the passage. An excellent example of this perfectly free paraphrase is to be found in Shakespeare's plays. In Julius Cæsar occur the two lines—

> 'The evil that men do lives after them;
> The good is oft interrèd with their bones.'

In Henry VIII. exactly the same idea is presented thus—

> 'Men's evil manners live in brass
> Their virtues we write in water.'

The anonymous writer of the *Museum* article already referred to remarks that in these two passages Shakespeare gives two distinct concrete expressions of the abstract thought which may be expressed in the general terms, 'Men are more apt to remember what is base in human nature, than what is good and pure.'

Dr. Bain suggests that the stanza from *In Memoriam*,

> 'I envy not in any moods
> The captive void of noble rage,
> The linnet born within the cage,
> That never knew the summer woods,'

may be paraphrased thus—'In no mood do I envy the captive that does not resent imprisonment—the linnet that never knew the summer woods, and is happy in the cage where it was born.'

This, which may be termed a plain paraphrase, he sets against the freer one given by Mr. Scott Dalgleish, but which Dr. Bain regards as very free and 'thoroughly prosaic':—

'I can only despise the indifference of those who, never having enjoyed the sweets of freedom, cannot sorrow for its loss.'

The next stanza of the same poem runs thus—

> 'I envy not the beast that takes
> His license in the field of Time,
> Unfettered by the sense of crime,
> To whom a conscience never wakes.'

In Dr. Morell's *Poetical Reader* it is thus freely paraphrased:—'I do not esteem as of any value the mere gratification of passion where no feeling of divine and personal responsibility is blended.'

As another illustration let us take two stanzas from Sir Henry Wotton's poem, '*The Happy Life*.'

> 'How happy is he born and taught
> That serveth not another's will—
> Whose armour is his honest thought,
> And simple truth his utmost skill.
>
> 'Whose passions not his masters are,
> Whose soul is still prepared for death—
> Not tied unto the worldly care
> Of public fame or private breath.'

Professor Meiklejohn, in his work on *The English Language*, gives the following, which is certainly a plain and only slightly varied version of these stanzas:—

'How happy, by birth as well as by education, is the man who is not obliged to be a slave to the will of another—whose only armour is his honesty and simple goodness, whose best and utmost skill lies in plain straightforwardness.

'How happy is the man who is not the slave of his own passions, whose soul is always prepared for death, who is not tied to the world or the world's opinion by anxiety about his public reputation or the tattle of individuals.'

For purposes of comparison with this example of plain or simple paraphrase we venture to submit the following rendering of the same stanzas:—

'The man is truly fortunate who, freed by birth and position from the duty of obeying another is yet, through disposition and training, protected from evil influences by honesty of purpose, and guided in all his doings by a strict regard for truth.

'And blest indeed is he whose desires are under the firm control of his will and reason, whose spirit is ever ready to meet death without fear, and whose independent position enables him, calm and unmoved, to disregard both popular applause and popular censure, and even the whispering tongue of slander.'

Two excellent specimens of paraphrasing are given by Dr. J. G. Fitch in his *Lectures on Teaching*, the one a paraphrase of part of Lord Bacon's Essay *On Studies*, and the other from the opening of Milton's *Paradise Lost*.

'Studies serve for delight, for ornament, and for ability. The chief use for delight is in privateness and retiring; for ornament is in discourse; and for ability is in the judgment and disposition of business. For expert men can execute, and perhaps judge of particulars one by one, but the general counsels, and the plots and marshalling of affairs come best from those that are learned. To spend too much time in studies is sloth; to use them too much for ornament is affectation; to make judgment wholly by their rules is the humour of a scholar. They perfect nature, and are perfected by experience. For natural abilities are like natural plants, that need pruning by study. And studies themselves do give forth directions too much at large, except they be bounded in by experience.

Crafty men contemn studies, simple men admire them, and wise men use them. For they teach not their own use, but that is a wisdom without them and above them, won by observation.'—LORD BACON.

Paraphrase: 'Learning is valuable in three ways—as a source of pleasure, as a means of adding grace and beauty to life, and as an instrument for the discharge of duty. The first of these advantages is chiefly enjoyed in solitude; the second is found in social intercourse, while its third use is that it helps us to order and arrange the business of life. For although men of natural acuteness can perform good work and form right judgments about its details, yet the power to view things comprehensively, to group them together, and to exercise a wise forethought in the arrangement of business is rarely possessed except by the well-instructed man.

'It is a mark of indolence to give ourselves up wholly to the enjoyment of literature; it is a proof of self-conceit to value our reading only as a means of display; while to determine all questions by what books say is the sure characteristic of a pedant. Learning supplements and improves natural gifts, but itself needs to be further improved by the experience of life, for our natural gifts are like trees which need discipline and culture, and learning itself is apt to mislead a student, unless its conclusions are corrected by actual experience. Learning is not unfrequently despised by the clever practical man; it is regarded with childish wonder by the foolish; but it is only truly appreciated by the wise. For learning does not teach its possessor how to employ it; the power to do this aright is a higher attainment than any scholarship, and can only come by thinking and observing.'—DR. FITCH.

'And chiefly Thou, O Spirit, that dost prefer
Before all temples the upright heart and pure,
Instruct me, for thou knowest; Thou from the first
Wast present, and with mighty wings outspread
Dove-like sat'st brooding on the vast abyss,
And mad'st it pregnant. What in me is dark
Illumine; what is low, raise and support;
That to the height of this great argument
I may assert Eternal Providence,
And justify the ways of God to men.'

MILTON: *Paradise Lost.*

'But most of all do I invoke Thine aid and teaching, Thou Holy Spirit, whose choicest dwelling place is the guileless and reverent human heart. Thou wast present at the beginning, and like a dove with outstretched pinions didst hover over the void and formless infinite, and impregnate it with life.

'In so far as I am ignorant, enlighten me; when my thoughts are mean or poor, elevate and sustain them, that so I may be enabled to utter words not unworthy of my lofty theme, to speak rightly of the Divine Government, and to vindicate the dealings of God with mankind.'—DR. FITCH.

From the course of this paper, and from the illustrations it contains, the reader will have gathered that writing a good paraphrase is not an easy exercise. On this point we may quote the opinions of some of Her Majesty's Inspectors who find fault with the students' attempts. Mr. Legard says, 'To an ordinary student it is a difficult task to give a faithful equivalent to a simple passage of English poetry;' and Mr. Alexander says, 'It is very difficult to paraphrase a good author with success.' For this reason paraphrasing is not a suitable exercise for those in the earliest stages of learning composition. For them a far more fitting exercise is one which has something indeed of the character of paraphrase, but which is much easier—that of writing the substance of a short story or anecdote which has been read out or told to the pupils.

For more advanced students, however, paraphrasing forms an admirable exercise. Whatever difficulties it possesses in regard to language and construction, it is free from one difficulty which belongs to the common task of writing a theme or essay on some abstract subject—a difficulty which some learners find almost insurmountable—that, namely, of calling up thoughts to express. The text of the passage to be paraphrased provides the thoughts, and the student cannot therefore complain of any lack of material for his exercise.

Great difference will however be found in the degree of difficulty attaching to paraphrasing of different passages. Simple passages, especially of poetry, expressed in ordinary idiomatic English, often present the greatest difficulty, inasmuch as it is almost impossible to vary the language and preserve the ease and simplicity which the nature of the subject requires.

Poetry or prose in which the construction is considerably involved and the language abounds in words of Latin origin, is not so difficult to paraphrase, if only the language and the construction are properly understood. Examples of this sort may be chosen from the

poetry and prose of Milton, and the prose of Hooker. The special difficulty presented by many passages from Shakespeare's Plays, Bacon's Essays, and such poetry as Robert Browning's is to be found in their extreme condensation. To paraphrase such passages effectively much latitude must be allowed in the matter of expansion in order to make the meaning clear.

As an example of such allowable expansion of a highly condensed passage we paraphrase the first stanza of Browning's *Rabbi Ben Ezra*:—

'Grow old along with me!
The best is yet to be,
The last of life, for which the first was made:
Our times are in His hand
Who saith "A whole I plann'd,
Youth shows but half; trust God: see all nor be afraid."'

Paraphrase: Let us together welcome old age. Our best days are still before us. Age is the crown of a perfect life, for which youth is but a time of preparation. A man's life is ordered by the Almighty who designed to make it a complete whole. The young man sees but the seed-time. Let him go forward, trusting to see its full fruition, and fearing not.

For those who are beginning to practise paraphrasing the most suitable passages for the exercise are probably such as may be so easily chosen from the narrative poems of Scott, the descriptive and reflective poems of Goldsmith, Cowper and Wordsworth, and, in prose, from the simple natural essays of Addison and some of his colleagues in *The Spectator*. In these authors the student is not usually confronted by the difficulties arising from obscurity of meaning, or extreme condensation in the expression. Where circumstances admit of it perhaps no better course could be adopted as a commencement, than taking some such poem as Goldsmith's *Deserted Village*, working steadily through it and paraphrasing at least the most striking passages in it.

So far we have endeavoured to make clear by explanation, by argument, and example, what is the nature of paraphrase, what are its uses, and what standard should be aimed at. It is hoped that the subject may have been rendered interesting, and that students may have gathered some useful guidance to the practice of paraphrasing. But it may be expected that we should proceed to lay down definite rules to be followed so as to acquire skill in the exercise. Now it has been very truly remarked by Mr. Currie, in his *Common School Education*, that 'Good paraphrasing cannot be performed by any mechanical rules: it takes its complexion in all cases from the general cultivation of mind in him who attempts it.' What can be placed before the pupil is first counsel, and then examples.

The first essential for good paraphrasing is a thorough understanding of the author's meaning. This is only to be gained by careful and thoughtful reading. The next is accurate knowledge of the use of words. This is a matter of degree. The study of such books as Miss Whateley's *English Synonyms*, Archbishop Trench's *Study of Words*, and *English Past and Present*, will be very helpful in the acquisition of this knowledge. A further help, almost as necessary, is acquaintance with literature of the best kind. This is to be gained by forming the habit of reading attentively over and over again some of the classical works of English authors, and especially by committing to memory some of the best poetry. The production of good paraphrase depends on the furnishing of the mind chiefly. When a good start is made, practice will do much to bring facility.

The commonest defects in paraphrase, or features to be guarded against, are the use of mere synonyms or apparent synonyms; diffuseness, or the use of too many words; looseness in the construction of sentences; the interpolation of ideas foreign to the original; vagueness in the interpretation of the author's ideas.

On the other hand the points to be aimed at are fitness of the words used; brevity, so far as is consistent with clear expression of the real meaning; harmony of the various parts, and, if possible, an easy and pleasant rhythm in the composition. Study of good examples and frequent practice are the means by which these marks of excellence may be obtained.

Additional examples will be found in THE PRACTICAL TEACHER, vol ix., p. 19, vol. x., pp. 71, 73, and throughout the various volumes in the Model Answers to Questions in English Grammar and Composition set at the Government Examinations for Pupil Teachers, and for Candidates for Admission and Certificates.

Tests in Mental Arithmetic.

STANDARD I.

1. Add ½ of 20 and ½ of 16. 18.
2. How many is that short of 2 dozen? 6.
3. How many quarters could I get out of 6 small apples? 24.
4. How many could I get out of 8 large ones? 32.
5. How many couples are there in 18? 9.
6. How many pence could you get for 40 farthings? 10.
7. How many more farthings are wanted to make a shilling? 8.
8. Divide a shilling among 24 children; how much is that for each one? ½d.
9. How many half-pennies could you get for 1s. 3d? 30.
10. If 5 boys have 2 pockets each, and 5 marbles in each pocket, how many marbles have they altogether? 50.
11. If they had 80 altogether, how many would they have had in each pocket? 8.
12. A woman had two score eggs, and she sold three dozen. How many had she left? 4.

STANDARD II.

1. What would 3⅓ lbs. of sugar cost at 3d. a lb.? 10d.
2. What would ¼ lb. cost? ¾d.
3. If you gave 6d., what change would you get? 5½d.

4. Divide 3 apples among 6 boys; what part is that for each boy? ½.

5. If there had been 6 girls in addition, what part would each one have got? ¼.

6. Take half of 18 from half of 26. 4.

7. How many nines are there in 243? 27.

8. Take 243 from 300. 57.

9. If I pay 3s. for 4 lbs. of beef, what would 2 lbs. cost? 1s. 6d.

10. What would 3 lbs. cost? 2s. 3d.

11. How many threepences could you get for a double-florin? 16.

12. How many double-florins could you get for £2? 10.

STANDARD III.

1. What change would you get out of a crown, after paying for 5½ lbs. of beef at 10d. a lb.? 5d.

2. How many threepences could you get for 7s. 9d.? 31.

3. How many more threepences are wanted to make half-a-sovereign? 9.

4. How many ounces are there in ¾ lb.? 12.

5. What would ¾ lb. of tea cost at 1½d. an ounce? 1s. 6d.

6. What would 2 lbs. cost? 4s.

7. What is the cost of 3 yards at 3d. a foot? 2s. 3d.

8. If the cost had been 3s. 9d., what would have been the price per foot? 5d.

9. What would a ton of coals cost at 9d. per cwt.? 15s.

10. What is the cost of a ½ cwt. of rice at 2d. a lb.? 9s. 4d.

11. How many seconds are there in 7½ minutes? 450.

12. How many score are there in that number? 22½.

STANDARD IV.

1. How many hours are there in February of a leap year? 696.

2. How many days are there in the first six months of the year? 181.

3. How many are there in the last six months? 184.

4. I bought a leg of mutton weighing 11 lbs. at 10½d. a lb. What change did I get out of a sovereign? 10s. 4½d.

5. If ½ lb. of tea cost 10½d., what will 5 lbs. cost? 8s. 9d.

6. How many lbs. of feathers are equal in weight to 1½ cwt. of coal? 168.

7. Add together all the silver coins. 15s. 3d.

8. Add ½ of a sovereign and ⅕ of a sovereign. 10s. 8d.

9. What fraction of 2 yards is 9 inches? ¼.

10. What fraction of £1 is 15s.? ¾.

11. What fraction of 1s. is 8d.? ⅔.

12. What is the difference between ¾ of 6d. and ⅔ of 6d.? ½d.

STANDARD V.

1. From ½ of 10s. take ⅕ of a florin. 2s. 8d.

2. What would ¾ cwt. cost at 9d. a lb.? £3 3s.

3. What is the cost of a thousand oranges at 4 a penny? £1 0s. 10d.

4. How much would half a quarter of a yard of silk cost at 5s. 6d. a yard? 8¼d.

5. What would 4 acres 3 roods of land be worth at £50 an acre? £237 10s.

6. If 10 articles cost 2s. 11d, what will a dozen cost? 3s. 6d.

7. Discount of 2d. in the shilling is allowed by a shopkeeper. How much is that on 4 guineas? 14s.

8. What fraction of 6s. 8d. is 1s. 4d.? ⅕.

9. Multiply 56 by 2¾. 136.

10. Express ⅝ as a decimal. ·75.

11. What vulgar fraction is equal to ·45? $\frac{9}{20}$.

12. Find the amount of £350 for 6 years at 4 per cent. £434.

STANDARDS VI. AND VII.

1. What is the cost of a window 3 yards by 2 yards at 1s. 6d. per square foot? £4 1s.

2. Multiply 19 by ·02 ·38.

3. Divide 19 by ·02. 950.

4. What decimal of a crown is a florin? ·4.

5. What decimal is a florin of three half-crowns? $\cdot2\dot{6}$.

6. What is the value of ·9 of 9s. 2d.? 8s. 3d.

7. A grocer gained £1 13s. 4d. on selling tea at 2s. a lb. which cost him 1s. 4d. How many lbs. did he sell? 50.

8. At what rate per cent will £500 amount to £600 in 5 years? 4 per cent.

9. What sum will amount to £420 in 5 years at 4 per cent? £350.

10. How much per cent. is a dividend of 7s. 6d. in the £? 37½ per cent.

11. How much in the £ is 40 per cent.? 8s.

12. What is the difference in price between a gain of 12½ per cent. and a loss of 8⅓ per cent. on an article costing 6s.? 1s. 3d.

—o—

How to Teach School Children to Sing from the Staff Notation.

BY W. G. McNAUGHT,

Associate of The Royal Academy of Music.

26. Intervals should also be numbered from the scale of sol-fa syllables written in a column on the board or from the tonic sol-fa modulator, and from time to time the connection should be shown between intervals expressed in these terms and their representation on the staff of lines. It must be made perfectly clear that the step from one scale tone to the next above or below is a *second*, and that therefore a step wider is a *third*, and so on. When the plan of numbering has been fully

explained and abundantly illustrated, questions to pupils may be usefully put in the following forms :—

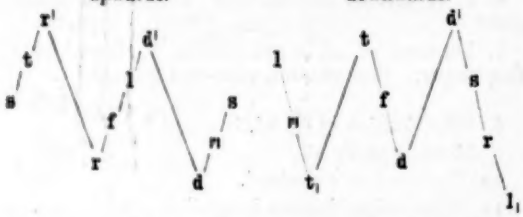
(*a*) What is the third or fourth, etc., above (or below) **ray** or **fah**, etc.?

(*b*) What is the interval from **doh** up to **soh**, etc., etc.?

(*c*) Name thirds or fourths, etc., above (or below) **soh**, etc., until you reach the name you started from :—

EXAMPLES.

Thirds starting from **soh** upwards. Fourths starting from **lah** downwards.



In this exercise it is best to accustom the pupil to transpose notes an octave when the following notes will be beyond the range of the scale written on the blackboard.

27. It must not be supposed that the whole of the theoretical course described in sections 19 to 26 must be taught to children in Standards I. and II. Even in favourable circumstances it may not be expedient to do more than commence the various topics in Standard II., and to reserve a fuller treatment for Standards III. and IV. The course of exercises is described in detail, and somewhat completely, in order that the teacher may know on what lines to work and what is useful in theory.

TUNE PRACTICE FOR DIVISION II.

28. The exercises to be sung should at first be timeless. They should consist sometimes of easy passages which the class can and therefore should be stimulated to sing with absolute correctness at first sight, and sometimes of exercises that have to be systematically studied until they are conquered.

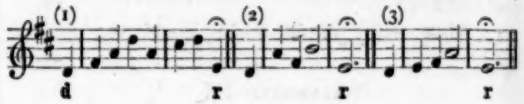
29. A class only too easily falls into the habit of singing a new exercise for the first time with no more mental vigilance than is given to a familiar exercise. It, therefore, not infrequently happens that a class accustomed to stumble over difficult exercises cannot sing at sight the simplest passages without the habitual hesitations. At almost every lesson some exercise should be given the difficulties in which the teacher is fully assured are quite within the capacity of the class, and every means should be taken to impress upon the class that as they are able to sing the exercise perfectly at sight they should strongly determine to do so. Then let it be well understood that if unfortunately a mistake is made by some, no breakdown is to be permitted, but that all are to make stronger endeavours to recover and go straight on. Treated in this way a singing lesson becomes a moral lesson of high value. In no other subject taught in the school are children trained to make a similar united endeavour to achieve a common purpose. The experienced teacher should make great use of the satisfaction and the desire to attempt more difficult tasks that comes with success, but he must take care not to discourage the class by expecting too much. A tune exercise is very easy when the only leaps are between tones of the key or **doh**-chord, and when the other tones are approached and quitted by step. For examples see Specimen Tests below.

It is a good plan to talk a little about the exercise before the class attempts the performance.

30. Each lesson should if possible include the special study of a difficulty. Thus the teacher may determine to give **ray**, the second of the scale, special attention. The first thing to do will be to demonstrate the peculiar effect of this tone in the most striking manner possible, and then to give the class the practice of finding it from every other tone of the scale. The expectancy of **ray** is the most noticeable part of its effect. This is best brought out by stepwise movement from above.

EXAMPLE.

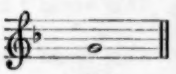
But the less easily felt effect of prayerfulness is better illustrated by a leap as in the following examples.



The next step is to get the class to sing the **ray** after any passage sung or played by the teacher.

Teacher Sings.

Class Responds.



ray

But the power of singing the **ray** when asked for in this way, may depend upon a recollection of absolute pitch rather than upon a perception of relation. Hence the true result of such an exercise can be estimated only by continually altering the key. When the exercise is given in this form it is well at first for the teacher to sing the *same* phrase in the various keys used.

Teacher Sings. *Class Responds.*

This practice can be pleasantly varied by the teacher undertaking to sing all the **rays** of a longer exercise, the class singing the other notes, or better still, an individual in the class should be selected to sing the **ray**. In this way the attention of the class becomes concentrated on the particular tone that is being studied.

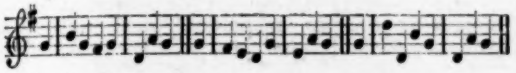
EXAMPLE.

Doh in 1st space.

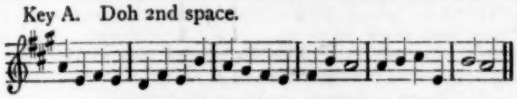
31. The effect of range upon scale tones must not escape consideration. The range from dominant to dominant, or from **soh**$_1$ to **soh**, gives to the **soh** a prominence that acts upon the other scale tones in a special way. This fact constitutes another reason against confining practice to the key of C, because in that key the range from dominant to dominant cannot be practised owing to the low or high pitch (G_1 or G^1) involved. A study of **ray** cannot be considered complete unless leaps from the **soh, lah,** and **te** below have been practised. In the keys of C and D it is also necessary to practise leaps to high **ray.**

EXAMPLES.

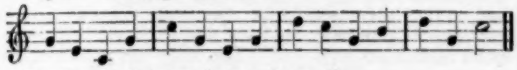
Key G. Doh 2nd line.



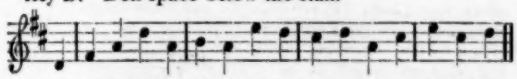
Key A. Doh 2nd space.



Key C. Doh leger line below.

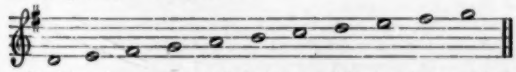


Key D. Doh space below the staff.



32. Another useful practical exercise that should be attempted occasionally is for the class to sing intervals as called for by the teacher. Such an exercise should follow the theoretical studies on intervals described in section 25. The following is the plan recommended :—

(1) Write a scale of semibreves in the key determined upon, *e.g.*, say the key of G.



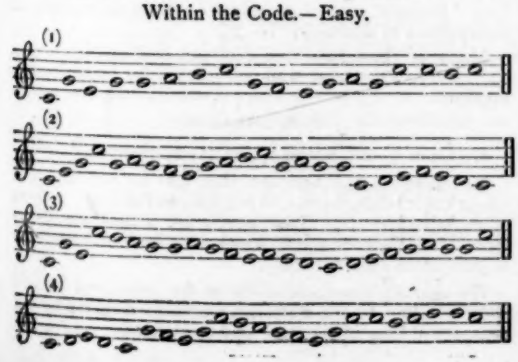
(2) Give the sound of **doh** (G). Tell the class to sing the 3rd above **d** (**m**), the 3rd above **m** (**s**), the 4th below **s** (**r**), and so on.

33. Still another form of reading exercise is useful. It is important to cultivate the power of grouping notes into phrases. The teacher writes a scale passage on the blackboard (the series in key G above will suffice for example) and warns the class to watch the pointer, and to notice and *remember* what was pointed. The teacher then points, say **doh, me, soh, fah, me,** and after the pointing is finished the class sings the phrase.

34. Even if the various exercises recommended have only been partially practised, tune tests in accordance with the provision of the Code will be found to present no difficulty to the class. The following are—

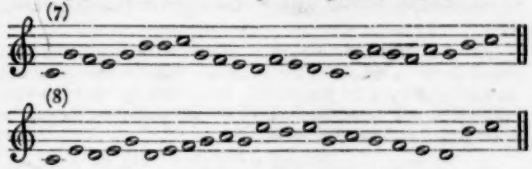
SPECIMEN NOTE TESTS FOR DIVISION II.

Within the Code.—Easy.

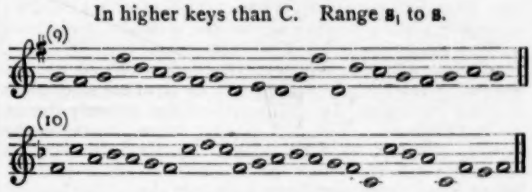


More Difficult.

Beyond the Code. Leaps to **ray, fah, lah,** and **te.**



In higher keys than C. Range **s**$_1$ to **s.**



(To be continued.)

—o—

Our Certificate Class.

BY DR. GEORGE BEACH, M.A.

Head Master of Christ Church Schools, Macclesfield,

Co-author of 'Our Mother Tongue,' &c.

GENERAL REMARKS.

1. Many of our Readers will be pleased to learn that it is not intended by Art. 50 of the New Code to deprive any Assistant Teacher of the qualification which he or she enjoyed at the date of the New Code coming into operation, which date as at present intended is 1st September, 1890.

2. On p. 6, of Form IX., the words '*Christmas Examination* should be written after the name of any Teacher who desires permission to attend the next Examination for Certificates.'

3. We are often asked whether the standard of examination is the same for Acting Teachers as for Students-in-Training. Practically no difference is made, the allowance (if now any) being not more than one per cent. in the First Division, and not more than three per cent. in the remaining Divisions.

4. In the May issue, the model Certificate answers, Mr. Bowden's excellent article on the New Code, the Query Column answers in Arithmetic and Algebra, and Mr. Richardson's Contracted Arithmetic should all be carefully studied.

5. Now that drawing is being rendered compulsory, we believe that the Education Department will for a considerable period allow great latitude as regards the qualification of the teacher. Everybody not yet having arrived at the 'D' should nevertheless hasten thereunto without loss of time.

6. Among our lady readers considerable confusion has been caused by the fact that Dr. Davies has compiled two manuals on the Stuart Period. The one we are working by is that at 1s. 6d., not the 2s. one, and it comprises an account of the literature of the period.

SPENCER ON EDUCATION.

We shall, throughout our remarks upon this work and in referring to any given passage therein, assume that our pupils have, like ourselves, invested their half-a-crown in the cheaper edition and not indulged in the six-shilling one.

On the threshold, it may at once be said that so valuable as a whole is the treatise that we feel it would be impertinence to praise it. Accordingly we wish this opinion to be remembered when we pass any strictures upon any small portion of it.

Mr. Spencer, like all original thinkers, like all prophets, like all zealous reformers, is however gifted with a capacity of seeing plainly his own side of the question, sometimes to the absolute exclusion of other important considerations. For instance, when quite properly condemning *the vicious system of learning by rote* (p. 27), he nowhere safeguards himself by urging the cultivation of the memory during early childhood. The fact is, that when the reasoning powers develop, to most minds learning by rote is extremely odious, whilst the retention is more fleeting. What things must be learned by rote should be learned as early as possible. Again, we think that in tilting at ill-digested schemes of education (pp. 22, 23), Mr. Spencer makes too little of that informal education that is always going on. He seems to forget that when away from lessons, and even during them, a child is by inevitable natural law taking part for itself in its own education. This is the same mistake that many advocates of the Kindergarten system make. Instead of simply asserting what would be but the bare truth, that their methods, by their conformity to child nature, most pleasantly and most profitably develop and train the infant mind, they often maintain that without the use of their principles scarcely any education, properly so called, can be initiated. These extreme views cannot however be right. The most common properties of matter are easily learned by experience, but in a less organised form, in a longer time and in a more painful manner. The difference, great as it is, is similar to that between, preparing in one case for an examination solely by private study and in another instance under tutorial guidance.

Utilitarianism is also by our author too much insisted upon. It is no secret that even now there are branches of higher mathematics upon which practical science has as yet made no demand. But he would be rash who would assert that these would never conduce in the future to the material well-being of mankind. History would convict him. We prefer, too, John Stuart Mill's definition of education, '*Whatever helps to shape the human being; to make the individual what he is, or hinder him from being what he is not—is part of his education*,' to Spencer's, '*The function which education has to discharge is to prepare us for complete living*' (p. 7).

The latter definition is neither so broad as the former, nor does it present the negative side of the question, nor does it so clearly include what may be termed spontaneous education.

If our space will permit we shall return to a little criticism later on, but now we go on to set forth the chief points in the first thirty-three pages, and of which all the remaining matter of these pages is simply an amplification. Our students are advised to underline the given passages.

(1) 'Decoration precedes dress.' (2) 'Dress is developed out of decoration' (p. 1). (3) 'Function is still in great measure subordinated to appearance.' (4) 'The like relations hold with the mind. Among mental as among bodily acquisitions, the ornamental comes before the useful.' (5) 'Men dress their children's minds as they do their bodies, in the prevailing fashion.' (6) 'In the treatment of both mind and body the decorative element has continued to predominate in a greater degree among women than among men' (p. 2). (7) 'Social needs have subordinated individual needs, and the chief social need has been the control of individuals' (p. 3). (8) 'Each tries to subjugate the others; and so aids in weaving that ramified network of restraints by which society is kept in order.' (9) 'So, in education, the question is, not the intrinsic value of knowledge, so much as its extrinsic effects on others' (p. 4). (10) 'The question of transcendent moment is, not whether such or such knowledge is of worth, but what is its *relative* worth' (p. 5). (11) 'We that have but span-long lives must ever bear in mind our limited time for acquisition' (p. 6). (12) TO PREPARE US FOR COMPLETE LIVING IS THE FUNCTION WHICH EDUCATION HAS TO DISCHARGE' (p. 7). (13) 'The estimation of the relative value of knowledge is difficult—perhaps never to be more than approximately achieved.' (14) Lines 17 to 28 (p. 8). (15) Last three lines of p. 9 and first three of p. 10. (16) 'Acquirement of every kind has two values—as *knowledge*, and as *discipline*' (p. 11). (17) Last five lines of p. 11 and first two of p. 12. (18) 'Direct self-preservation is in a great part already provided for.' (19) 'What we are chiefly called upon to see is that there should be free scope for gaining this experience and receiving this discipline relating to self-preservation' (p. 12). (20) 'The body has to be guarded against disease and death that follow breaches of physiologic law.' (21) 'Men do not even know that their sensations are their natural guides' (p. 13). (22) 'Knowledge which subserves direct self-preservation by preventing loss of health is of primary importance.' (23) 'A course comprising the general truths of physiology is an all-important part of a rational education' (p. 15). (24) Review of the utility of Science in its three divisions, Abstract, Abstract-Concrete and Concrete-Logic (p. 16), Mathematics, Mechanics (p. 17), Heat, Light, Electricity, Chemistry (p. 18), Astronomy, Geology, Biology (p. 19), Sociology or Social and Political Economy (p. 21). (25) 'Mechanical knowledge may turn the national fate' (p. 18). (26) 'That which our School Courses leave almost entirely out most nearly concerns the business of life' (p. 22). [N.B.—In eleventh line from foot of p. 22 read '*dead*' instead of '*deal*.'] (27) 'The impression that some of the feelings are wholly bad, is not true of any one of them; that other feelings are good however far they may be carried, is also not true of any one of them.' (28) 'Truly salutary discipline visits on all conduct, good and bad, the natural consequences pleasurable or painful' (p. 25). (29) Lines 4—8, p. 26. (30) 'Hardly any parents and but few tutors know anything about psychology.' (31) 'Parents thrust primers into the hands of their little ones years too soon.' (32) 'Words contained in books can be rightly interpreted into ideas, only in proportion to the (p. 26) antecedent experience of things' (p. 27). (33) Lines 25—29 (p. 28). (34) 'Only now are historians beginning to occupy themselves with the phenomena of social progress' (p. 30). (35) 'Men should learn what social phenomena co-exist with what others.' (36) 'The only History that is of practical value is what may be called Descriptive Sociology' (p. 32). (37) 'Biology and Psychology are indispensable as interpreters of Sociology' (p. 33).

Many of these indicated excerpts, such as Nos. 10, 12, 14, 15, 17, 27, 32, 36 and 37, should be committed to memory.

PARAPHRASING.

1. (Lines 5—28, Scene 1, Act II., Richard II.)

Nevertheless it is believed that just as well-arranged music commands the ear, so forcible are the last utterances of expiring people. Last words are almost always remembered, for they are spoken under such circumstances as guarantee their accuracy.

We hearken more attentively to the sincerity of farewell speeches than to the flattering remarks dictated by the prospect of long intercourse and prosperity.

The termination of our careers is more noted than the careers themselves.

The end of an enjoyment, the close of the day, the 'dying fall' of a melody, because they are all conclusions, dwell more fondly in our memory than the long previous duration of the pleasure, the events of the day, or the strain of the song.

If Richard refuse to listen to Gaunt's advice when living, yet perhaps his dying words may influence him, ETC.

2. (Lines 31—60, Scene 1., Act II., Richard II.).

It seems to me that my last words are inspired prophecies respecting the king. His highness' hasty impetuosity will soon expend itself, for the quicker the combustion the sooner the fuel fails, and whilst gentle rains may continue for a considerable period yet heavy falls are soon over. They who start too quickly are wearied too soon. They who eat too greedily eat nothing at all, but suffocate themselves. Thus it is with frivolous conceit—like an unsatisfied shark, after devouring all else, it feeds upon its kind, ETC.

3. (Lines 14—24, Scene 2, Act II., Richard II.)

Every real sorrow has multitudinous accompaniments, that appear additional troubles, but are merely concomitants. For the perturbed mind, confused by puzzling thoughts, out of one perplexity manufactures many; as prismatic glasses which looked through just as you stand present many images, but if placed at the right angle represent the one object clearly.

In this way, your highness finds many more sorrows to grieve over than the loss of the king himself, when you are considering his departure.

These, however, are simply semblances of things non-existent, ETC.

N.B.—The meaning of the simile here employed is not very clear, and might be understood otherwise than we have taken it.

4. (Bacon's Essays, No. XXV. 4th paragraph.)

Although repetitions are generally mere waste of speech, yet the frequent bringing forward (recalling) of the exact point at issue is a great economiser; for many an utterance utterly outside the question is thereby prevented, even when just about to be given vent to.

In urgent matters it is as absurd to employ lengthy and ostentatiously-elaborate speeches, as to equip oneself for competitive running in flowing garments with impeding folds. Preliminary observations, discursive remarks, apologetic expressions and all personal allusions are useless, and after all are braggadocio parading in the guise of humility, ETC.

5. (Lancelot and Elaine, Lines 464—476.)

Lancelot's acquaintance and relatives were engaged in the contest upon the side of Arthur's Knights, who were challenging all comers. These mighty men were angry that an unknown cavalier should equal and perhaps overpass the prowess of their kinsman.

They were amazed and spoke to one another of the stranger enquiringly, ETC.

PARSING.

1. (Lines 112—122, Scene 2, Act II., Richard II.)

One, both, 'defend, again, wronged, whom, right, well, somewhat, cousin, should, uneven, seven.

2. (Lines 153—162, Scene 1, Act II., Richard II.)

So, doth, spent, so, much, like, venom, else, only, for, ask, moveables, whereof, possessed.

3. (Lines 21—34, Scene 3, Act II., Richard II.)

Harry Percy, sent, whencesoever, had thought, why, no, lord, forsook, dispersed, what, when, because, traitor, sent, power.

4. (Lines 138—152, Scene 3, Act II., Richard II.)

Upon, to do, right, tell, laboured, all, be, may, that, are, all, coming, but, own, see, well.

BACON'S ANTITHETA.

The Antitheta of Essays 1, 4, 9, 11, are given in August and September numbers for 1889. We shall append a few more. Our space will not permit all to be inserted.

Essay II.—

For.	*Against.*
1. It is absurd to prefer the appendages of Life to Life itself.	1. While philosophers make so much preparation to front death, they make death all the more fearful.
2. Whatever be our goal, yea though it be virtue, a long course is better than a short one.	2. Men fear death because they know it not, as boys fear the dark.
3. Without a fair length of life, one finds no time to do, nor to learn, nor to repent.	3. No human passion is so weak but, if roused a little, it can master the fear of death.
	4. A man would die though he were neither valiant nor miserable [prudent], only upon a weariness to do the same thing so oft over and over.

Essay XIV.—

1. Those who have virtue in the blood find baseness not so much alien to them as impossible.	1. It is rare for virtue to beget nobility; still rarer for nobility to beget virtue.
2. Nobility is the laurel wreath wherewith men are crowned by time.	2. Nobility have more often to thank their ancestry for pardon than for advancement.
3. We respect antiquity even in lifeless monuments; how much more in living ones!	3. Such is the energy of rising men, that by their sides noblemen seem motionless statues.
4. If one is to despise nobility in a man's relations, what will be the difference between the offspring of men and the offspring of beasts?	4. Noblemen look back too often in the race—a sign of a bad runner.
5. Nobility withdraws virtue from envy and recommends it to favour.	

HISTORY.

Males.

(1) (Davies, pp. 75—89.)

NOTHING in the above portion should be omitted.

(2) (Davies, pp. 90—103.)

Pages 91, 92 and 93 may be simply 'skimmed.'

(3) (Davies, pp. 195—207.)

OMIT 'Damon and Pythias,' 'Premoso Cassandra,' 'Gammer Gewten's Needle,' Stephen Hawes, Rober Henryson, Alex. Barklay, and Sir Richard Maitland.

(4) (Davies, pp. 189—193.)

NOTHING in this portion should be disregarded.

Females.

(1) (Davies, pp. 104—110.)

OMIT Lord Brooke, Samuel Daniel, Sir Henry Wotton, and Thomas Middleton.

(2) (Davies, pp. 110—116.)

OMIT George Sandys, Francis Corbet, Webster, Thomas Dekker, Thomas Carew, Thomas Randolph, and William Habington.

ROUTINE FOR JUNE (MALES).

DAY	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
MONDAY	**Algebra.** — Revision	**History.** — Dates from 1307 to 1461 Houses of York and Lancaster	**School Management.** — What provision would you make for training your Pupil Teachers in the art of Teaching?	**Algebra.** — Quadratic Equations	**History.** — Outlines from 1603 to 1625 and Revision	**School Management.** — Notes of a Lesson on Emigration	**Algebra.** — Theory of Indices	**History.** — Revision	**School Management.** — What are the ordinary scholars' moral defects, and how should they be met?	**Algebra.** — Government Questions (See Article)	**History.** — Outlines rom 1625 to 1685	**School Management.** — Management of the Voice, Windows, Gaslights, and Colouring of School-room.
TUESDAY	**Euclid.** — First 70 Deductions of Egan, Part II.	**Map.** — Ireland	**English.** — Paraphrase Lines 5—28. Scene 1, Act II., Richard II.	**Euclid.** — First 9 Propositions of Book IV.	**Map.** — Victoria.	**English.** — Paraphrase 'Iterations are commonly loss of time . . . . to make the unguent enter.' Bacon's Essays, No. XXV.	**Euclid.** — First 115 Deductions of Egan, Part II.	**Maps.** — Indus and Ganges.	**English.** — Paraphrase Lines 464—476 Lancelot and Elaine	**Euclid.** — Revise Book II.	**Geography.** — Currents.	**English.** — Paraphrase Lines 31—60, Scene 1, Act II., Richard II.
WEDNESDAY	**Arithmetic.** — Discount	**English.** — Write 20 lines of Composition on Lines 275—276 of Scene 4, Act I., Richard II.	**Euclid.** — Revise any Euclid to end of Book III.	**Arithmetic.** — Stocks. (See article.)	**English.** — Write 20 Lines of Composition on 'Little strokes fell great oaks.'	**Euclid.** — First 100 Deductions of Egan, Part II.	**Arithmetic.** — Race and train questions (See Article.)	**Algebra.** — Work off arrears of study	**Euclid.** — Revise Book I.	**Arithmetic.** — Problems involving L.C.M. or G.C.M. (See Article)	**English.** — Richard II. to end of Scene 6, Act V.	**Euclid.** — First 145 Deductions of Egan, Part II.
THURSDAY	**School Management.** — To end of p. 37, Jevon's Logic Primer	**Geography.** — Our African Possessions not in the South	**English.** — Richard II. to end of Scene 1, Act IV.	**School Management.** — Spencer on Education. (See Article thereon)	**Geography.** — Revise Our African Possessions	**English.** — Lines 1055—1225 of Lancelot and Elaine	**School Management.** — 1 The Conscience Clause. 2 Laws of Half Timers. 3 Laws of School-fees. 4 'Farming' Schools v. Fixed Salaries	**Geography.** — Canada	**English.** — Richard II. to end of Scene 2, Act V.	**School Management.** — Spencer on Education (See Article thereon)	**Geography.** — Flora and Fauna of the Tropics	**English.** — 1 Place of Tennyson among English Poets 2 His chief works 3 His style
FRIDAY	**Algebra.** — Quadratic Equations	**History.** — Reign of Mary, pp. 75 to 89, Davies	**Writing.** — 1 Dictation 2 Copy Book 3 Word or passage previously set	**Algebra.** — Quadratic Equations	**History.** — Literature, pp. 195 to 207, Davies	**Arithmetic.** — Difficult Interest	**Algebra.** — Theory of Indices	**History.** — Reign of Elizabeth, pp. 90 to 103	**Geography.** — Canada	**English.** — Write 20 lines of Composition upon 'The Star Chamber.'	**History.** — Revise	**English.** — Bacon's Essays, 50, 1, 2 and 4
SATURDAY	**Euclid.** — First 85 Deductions of Egan, Part II.	**English.** — Bacon's Essays, 30, 31, and 32	**School Management.** — Water Supply of Schools. Construction of Buildings. (To end of p. 67 of Carpenter's Hygiene	**Geography.** — Winds	**Euclid.** — All Book IV.	**Examination** — Miscellaneous (See Article)	**School Management.** — The Summary Register	**Euclid.** — First 130 Deductions of Egan, Part II.	**English.** — Bacon's Essays, 36, 38 and 39	**Geography.** — Effect of Climate upon the Races of Man	**Algebra.** — Government Questions. (See Article)	**History.** — Lives of Great Men, pp. 189—193, Davies	**Examination** — Miscellaneous (See Article)	**English.** — Lines 1225—1418 of Lancelot and Elaine

ROUTINE FOR JUNE (FEMALES).

DAY	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
MONDAY	Arithmetic. — Government Questions. (See Article)	History. — Dates 1660 to 1674. Curtis' Date Book	School Management. — What provision would you make for training your Pupil Teachers in the Art of Teaching?	Arithmetic. — Interest	History. — Charles I.'s Parliaments	School Management. — Notes of a Lesson on Emigration	Arithmetic — Stocks	History. — The Great Rebellion	School Management. — What are the ordinary scholars' moral defects, and how should they be met?	Arithmetic. — Discount	History. — Madras founded, Cotton and Silk Manufactures, Newspapers	School Management. — Management of the Voice, Windows, Gaslights and Colouring of Schoolroom
TUESDAY	Domestic Economy. — Compare the advantages and disadvantages of the ordinary methods of Cooking	Geography — Map of British North America	English. — Paraphrase Lines 5—28, Scene 1 Act II., Richard II.	Domestic Economy. — Describe a few refreshing beverages suitable for sick persons	Geography. — Maps of Newfoundland and the Great Lakes	English. — Paraphrase Lines 14—24, Scene 2. Act II., Richard II.	Domestic Economy. — What would it cost to clothe 50 girls (ranging from 10 to 15) per year? (Give particulars)	Geography. — Map of West Indies	English. — Analyse and Parse difficult words of lines 153—162, Scene 1, Act II., Richard II.	Domestic Economy. — How would you encourage Frugality and Saving among your Scholars?	Geography — British Columbia, Vancouver's Island, Newfoundland	English. — Paraphrase Lines 31—60, Scene 1, Act II., Richard II.
WEDNESDAY	Arithmetic. — Fractions	English. — Write 20 Lines of Composition on Lines 275 and 276, Scene 4, Act I., Richard II.	Sewing, etc. — Learn the measurements and draw a diagram of 'a boy's shirt'	Arithmetic. — Insurance	English. — Write 20 Lines of Composition on 'Little strokes Fell great oaks'	Sewing, etc. — Shew (on sectional paper) representing a square yard the plan of cutting out a boy's shirt	Arithmetic — Consuls, Brokerage, Preference Shares, Debentures, Premium Par, Discount, etc.	Sewing, etc. — Shew (on sectional paper) representing 54 ins. by 36 ins. the plan of cutting-out a woman's night-dress	Domestic Economy. — Vaccination, its history, theory, advantages and disadvantages, Innoculation.	Arithmetic — Government Questions. (See Article)	Sewing, etc. — Learn the measurements and draw a diagram of 'a child's muslin pinafore'	Domestic Economy. — State what you know (mentioning advantages and disadvantages) of Sick, Death and Benefit Clubs
THURSDAY	School Management. — To end of p. 37 Jevon's Logic Primer	Geography. — Canada	English. — Notes and Text of Richard II. to end of Scene 4, Act V.	School Management. — Spencer on Education. (See Article thereon)	Geography. — Hindostan	English. — Analyse and Parse difficult words of lines 112—122, Scene 2, Act II., Richard II.	School Management. — 1 The Conscience Clause. 2 Laws of School Fees. 3 Laws of Half-Timers. 4 Farming Schools v. Fixed Salaries.	Geography. — Manitoba and N.W. Territory	English. — Notes and text of Richard II. to end of Scene 6, Act V.	School Management. — Spencer on Education. (See Article thereon)	Geography. — Revise European Possessions	English. — Notes and text of Richard II. to end of Scene 2. Act I,
FRIDAY	Arithmetic. — Compound Proportion.	History. — Literature, etc., Davies, pp. 104 to 110 (See Article)	Writing. — 1. Dictation. 2. Copy Book, 3. Copy previously set.	Arithmetic. — Government Questions. (see Article)	History. — Petition of Right, Ship-Money, Abolition of Star Chamber, etc.	Sewing, etc. — Cut-out and set-on the yoke of a boy's shirt	Arithmetic — Discount	History. — The Solemn League and Covenant. Irish Affairs of Charles I.	Any backward work	English. — Write short lives of— 1. Milton, 2. Baxter and 3. Hobbes	History. — Dates 1674 to 1685 Curtis' Date Book	Sewing, etc. — Practise 'Plain' Sewing
SATURDAY	Domestic Economy. — Describe a few easily prepared and nourishing dishes suited to a schoolmistress living alone	English. — Trench, Lecture III.	School Management. — Water supply of schools, Construction of Buildings, To end of p. 67 of Carpenter's Hygiene	Geography — Nova Scotia, Cape Breton, New Brunswick	Sewing, etc. — Practise plain sewing	Examination — Miscellaneous (see Article)	School Management. — The Summary Register	Domestic Economy. — Describe the duties of a House-Maid and Kitchen-Maid	English. — Richard II., Notes on the Language of the Play	Geography — Revise South Africa	Sewing, etc. — Cut out and set-on the yoke of a woman's night dress	History, Literature, etc. — Davies, pp. 110 to 116 (see Article)	Examination — Miscellaneous (see Article)	English. — Trench, Half of Lecture I.

SCHOOL MANAGEMENT.

Selected Government Questions on the portions already studied.

1. What constitutes 'attendance' in a Day School, an Infant, School and an Evening School respectively? Explain by help of a specimen extract from a Register, the marks used, and the methods of verification.

From what registers and in what manner would you ascertain the following particulars required for the Manager's Annual Return (Form IX.)?:—

(*a*) The number of times the school has been open.

(*b*) The average attendance for the year.

(*c*) The number of scholars admitted and the number removed from the roll during the year. (1882.)

2. Make out a Time Table for—

(*a*) A mixed school of 200 scholars, including an infant class; OR

(*b*) Standard III. (Boys or Girls), taking two class subjects. (1882.)

3. What is the object of *Practice*? What knowledge of Arithmetic should a class have before commencing this rule? Show in the form of an introductory lesson the various steps by which you would explain this arithmetical process to children. (1883.)

4. Define the terms *education* and *instruction*. Explain the statement that 'Nature itself points out the safe course, and the faculties which first require development are those in which there is the least fear of overtraining.' (1884.)

5. Show how a habit of close observation of the distinctive characteristics of objects presented to young children may be most effectually cultivated? (1885.)

6. Describe the best devices you know of: (*a*) for ventilating; and (*b*) for warming a schoolroom. (1886.)

7. What books on the History or Philosophy of Education do you intend to read after the attainment of your certificate, in order to become more fully qualified for the duties of your profession? (1886.)

GEOGRAPHY.

1. Pamphlets about Canada can be gratuitously obtained from the agents for the Dominion located in various parts of England.

2. Mr. Gardiner's 'How to Draw a Map' should be by this time well digested.

3. The 'Fishery Question' between England and Canada on the one side, and France and America on the other, needs attention.

4. The steps taken towards the confederation of our various colonies in North America, South Africa and Australia are of great importance.

ALGEBRA.

Answers to May Questions.

(1) 505 hurdles. Consider the hurdles in the first case 7 feet long, and in the second case 9 feet long.

(2) 24 miles per hour.

(3) 20 minutes.

(4) $x = 2$. This answer could have been found by inspection, for evidently x is positive, and $\sqrt{x}$ is integral, $\therefore$ as 2 is the co-efficient x must be $2n^2$, so that $2x$ *must* be $(2)^2 \times n^2$ or $(2n)^2$. From the equation we also see that $\sqrt{2x-3}$ or $\sqrt{(2n)^2-3}$ must be positive and integral; $\therefore$ to satisfy the equation $\sqrt{(2n)^2}+\sqrt{(2n)^2-3}=3$, it is plain that n must be 1, and $\therefore$ $2n^2$ or x must be 2.

(5) $\frac{a}{\sqrt{5}}$ or $\frac{a\sqrt{5}}{5}$.

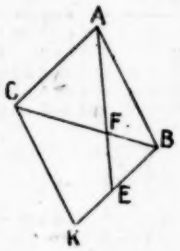
(6) $x = 2\frac{1}{2}$, $y = 5\frac{1}{2}$. Arrange the equations thus: $x^2 - 9y^2 = -266$ and $x - 3y = -14$, and divide the first by the second, etc.

(7) $x - 2y$. There is an error in the question. The co-efficient of xy^2 should have been -192 and not -190.

(8) $x = 6$; $y = 2$. Arrange the equations thus: $x^2 + y^2 = 56 - 2x - 2y$ and $2xy = 8 + 2x + 2y$. Then by addition $x^2 + 2xy + y^2 = 64$, etc.

EUCLID.

Question 15 is an excellent example of what may be termed a subsidiary deduction depending upon a KEY one.

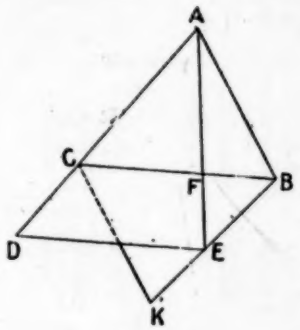


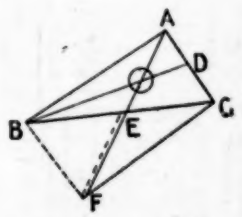
Key deduction.

If ABKC be any parallelogram of which BC is a diagonal, and E the middle point of BK, then AE will trisect BC in F.

Now in the subsidiary deduction, if BE be produced to K, so that BK = AC or AB and KC be joined, then ABKC is a parallelogram, and its diagonal BC is trisected in F as in *key* deduction.

Other important subsidiary deductions upon this *key* deduction are:—





(1) If in any triangle ABC, D and E are respectively the middle points of AC and BC, and if BD and AE intersect at O, then OE = $\frac{1}{3}$ AE, and OD = $\frac{1}{3}$ BD.

By producing AE to F, making EF = to AE and joining FB and FC, the parallelogram ACFB is constructed, and BD trisects AF in O.

Then $\because$ AO = $\frac{1}{2}$ AF $\therefore$ AO = $\frac{2}{3}$ AE, $\therefore$ OE = $\frac{1}{3}$ AE. Q.E.D.

(2) From (1) may easily be proved the following:—

The three mediants (or medians) of a triangle meet in a point.

(N.B.—The mediant of a triangle is the straight line drawn from the vertex to the middle point of the base.)

(3) Given the mediants of a triangle, to construct it.

ARITHMETIC.

(13) £682 2s. 6d. ; £735 12s. 6d. ; £508 5s.

(14) Average 440 yards per minute; decrease 13¾ yards per minute.

QUESTIONS FOR THIRD SATURDAY AND FOURTH MONDAY.

Males.

(Time, two hours.)

1. Each of two bags contains 228 coins, sovereigns and shillings only; one contains as many sovereigns as the other shillings, and its contents are worth twice as much as those of the other; find the number of shillings in each. (1878.)

2. Prove that $(a^m)^n = (a^n)^m$. Explain the meaning of the terms $a^{-\frac{1}{2}}$, $a^{\frac{1}{2}}$, and express with one simple index $(a^2)^{50}$, $(a^2)^{-50}$, $(a^{-2})^{50}$, $(a^{-2})^{-50}$, and find their continued product. (1878.)

3. Find values of x and y that satisfy the equations :—

$$\left.\begin{aligned} x^2 + 7xy &= 46 \\ xy + 16y^2 &= 150 \end{aligned}\right\} \quad (1878.)$$

4. Prove that a quadratic equation can only have two roots, and form the equation whose roots are 7 and — 3. (1881.)

5. Show that $x^2 + y^2$ is never less than $2xy$ and $x + \frac{1}{x}$ is never less than 2, when x and y are real and positive. (1881.)

6. Extract the square root of $a^2 - 4a^{\frac{3}{2}}b^{\frac{1}{2}} + 10ab - 12a^{\frac{1}{2}}b^{\frac{3}{2}} + 9b^2$. (1875.)

7. If 3 persons can do a piece of work in a, b and c days respectively, in what time can they do it working altogether? (1875.)

8. A certain number of trees planted 11 yards apart would just go round the four sides of a square field, but if planted 10 yards apart 110 more trees would be required. Find the area of the field in acres. (1876.)

ARITHMETIC.

Females.

(Time, three hours.)

1. What ought to be the price of £100 of Bank Stock which pays a dividend of £10½ per cent., in order that 4 per cent. may be realised on the money invested? (1874.)

2. A piece of wire was cut into two lengths which bore to one another the relation of ⅔ to ¼, and the difference in length was 1 inch. What was the length of the wire? (1874.)

3. A woman by selling eggs at the rate of nine for 7d. gains 12 per cent. ; at what price per doz. must she sell them to gain 20 per cent. ? (1875.)

4. Define True Discount and Banker's Discount. The difference between True Discount and Banker's Discount on a bill due 12 months hence is £15. Find the amount of the bill, interest being calculated at 5 per cent. per annum. (1875.)

5. A sum of £763·5 at simple interest for 6½ years amounts to £962·01 ; what is the rate per cent. ? (1876.)

6. How much wine at 16s. 8d. per gall. must be mixed with wine at 25s. per gall. in order to have 250 galls. at 19s. 2d. ? (1876).

7. What illustrations would you place on the blackboard to show the truth of the following expressions?—

$\frac{2}{3}$ of $\frac{3}{4} = \frac{1}{2}\frac{1}{2}$ and $\frac{3}{4} + \frac{5}{8} = 1\frac{1}{8}$. (1876.)

8. £13,450 being invested in the Three per Cents. at 97¼ and ½ charged for brokerage, find the annual income, after deducting income tax of 3d. in the £. (1876.)

9. A man changes 45 horses for 700 sheep. If 125 horses are worth 300 cows, and 750 sheep are worth 120 cows, find the gain per cent.

MISCELLANEOUS AND SELECTED GOVERNMENT QUESTIONS FOR SECOND AND FOURTH SATURDAYS.

Males.

1. Name and describe the several methods with which you are acquainted for teaching very young children to read. What use of the blackboard may be made in a reading lesson? (1870.)

2. In what way would you treat the following cases?—

(*a*) Continued absence from school.
(*b*) Copying in lessons.
(*c*) Cheating in playground.
(*d*) Using bad language.
(*e*) Uttering a known falsehood.
(*f*) Wilful idleness or carelessness. (1873.)

3. Make out a time-table for a mixed school of 150 boys and girls. State how you would organise such a school, and what teaching staff you would require. How would you employ the boys when the girls were engaged in needlework? (1874.)

4. Write a brief essay on the force of *Example* as a means of school discipline. (1870.)

5. Point out some peculiarities of the style and language of Richard II., and illustrate your criticisms by short passages (not less than six). (1874.)

6. Point out the peculiarities of the following :—

> By the cause you come—the frozen ridges of the Alps or any other ground inhabitable—I may never lift an angry arm against His minister—let's all go visit him—vex not yourself nor strive not—the envy of less happier lands—no venom else but only they have privilege to live—whom both my oath and duty bids defend.

7. Draw a sketch map of Nova Scotia and New Brunswick. (1872.)

8. Enumerate the British South African Colonies, with their seats of government, mountain ranges, rivers and ports. (1878.)

9. What West Indian Isles belong to England? Name their principal productions, and describe briefly the effect of slave emancipation upon their industries. (1878.)

10. What policy did Elizabeth pursue towards Protestantism in Scotland, France and Holland? (1880.)

11. What were the principal events of the following years :—1513, 1534, 1558, 1572, 1588 and 1600? (1874.)

12. Mention the most celebrated of the Elizabethan poets, and give some account of their works. (1880.)

13. A crown made of gold and silver weighs 150 ozs., and displaces 13·824 cubic inches of water. Had it been of pure gold it would have displaced 12·96 cubic inches, and if of pure silver it would have displaced 23·04 cubic inches. Find the weight of gold and silver in the crown. (1880.)

14. If the penny a mile railway fare be 40 per cent. below second class fare, and the second class fare be 30 per cent. below the first class, and if return tickets are issued at a fare and three-quarters, what ought to be the price of a first class return ticket for 250 miles? (1880.)

15. The figure formed by joining the points of bisection of the sides of a quadrilateral taken in order, is equal to one-half of the whole figure. (1881.)

16. In a given circle inscribe a triangle, equiangular to a given triangle. (1881.)

Females.

Questions 1—9 *inclusive, as for Males.*

10. Describe the character of James I. ; and point out the unconstitutional measures that marked his reign. (1878.)

11. Cive some account of the events in Scotland of the year 1650, and write a brief life of one of the leading Scotchmen of the 17th century. (1878.)

12. What was the purport of the Declaration of Breda? Point out *all* the ways in which it was infringed. (1878.)

13. Describe as to a class of elder children, the process of hemming, whipping and setting on a frill. (1880.)

14. Distinguish between the flesh-forming and warmth-giving ingredients in food. Explain how the ingredients of butcher's meat may be compensated for by the ingredients in vegetable substances. (1880.)

15. Give receipts for a meat pudding, a light pudding for invalids, and a meat soup. (1881.)

16. Mention a few of the most accessible and efficacious disinfectants; and state the manner of their use in cases of infection. (1881.)

CORRESPONDENCE.

1. *We shall be pleased to reply briefly and through this column to any seeking information or advice. Endorse* 'CERTIFICATE EDITOR' *if the office be communicated with.*

2. *Replies demanding urgency will be promptly forwarded per post on receipt of stamped and directed envelope. This privilege does not extend to furnishing solutions and answers to examination questions. A post will be saved by addressing direct to Macclesfield.*

3. *Any suggestion tending to the greater utility and interest of these articles, or to the greater convenience of* 'COACH' *or* PUPIL, *will be thankfully received and thoughtfully considered.*

A. B. (Masham), SUBSCRIBER (Stoneydale), F. R. (Patricroft), two letters; N. T. (Peel), R. M. (Sunderland), S. J. G. (Middlesbro'), DAISY (Barton), S. T. (Pontypool). U. R. J. (Winchester), A. C. (Darlington), WORK (Chelmsford), G. S. J. (Pickering), GUY (Warwick), CHARITY (Axminster), J. M. (Coventry), F. R. T. (Settlebeck), GUY (Ripon), answered per ordinary letter.

S. W. (Rochdale).—It is not likely that the Certificate Examination will be next year totally closed to Acting Teachers.

J. R. (Todmorden).—The disqualification is removed. See our 'General Remarks.'

MAY (Stockton).—You should reach a 'first' or 'second,' but *work* is the principal factor in obtaining a good position. No amount of '*tips*' are of use without industry.

J. (Birmingham).—All the requisite information about books is given in the March issue. Our space will not allow its repetition.

DOUBTFUL (Salford).—The mistake is ours, but we have corrected it this month.

OWL (Erdington).—You will see that our Correspondence conditions exclude the forwarding of answers to be examined.

DUB (Cardiff).—The change of schools will not affect your status.

(*To be continued.*)

—o—

How my School was Examied.

BY THE HEAD MASTER OF A COUNTRY MIXED SCHOOL.

STANDARD I.

Writing.—Ten words were dictated:—

Home, Evening, Pencil, Thought, Could, Garden, Room, Work, Knit, Sew.

A paragraph from the reading book had to be transcribed.

Arithmetic.—Two sets of sums were given.

A. 1. 717 + 95 + 603 + 8 + 24.

2. From 601 take 9.

3. Take 117 from 308.

B. 1. 374 + 608 + 99 + 756 + 275.

2. Take 18 from 711.

3. From 461 take 307.

Answers.—*A.* (1) 1,447; (2) 592; (3) 191.

B. (1) 2,112; (2) 693; (3) 154.

Mental Arithmetic.—The Inspector required each child to answer very quickly in tables, and also asked such questions as the following.—

7 + 3 + 2; 8 + 19; 25 + 1; 99 + 2.

Take 7 from 12; 8 from 20; 11 from 16.

How many legs have 12 horses? How many have 10 sheep and 5 ducks? How many boys could have threepence each out of a shilling? out of ninepence? out of half-a-crown?

Poetry.—The piece prepared for repetition was 'The Better Land' by Mrs. Hemans.

Geography.—The Inspector questioned on the plan, points of the compass, North Pole star, and the map. What is the meaning of a map? Where is the south of the map? the south west of the map? How could you find the north on a dark, cloudy night? What is the mariner's compass? What is the needle? What is it made of? Where is the sun at 12 o'clock at noon? Where is the sun in the evening? Where do you never see the sun? Show mountains on the map. Show a cape; an island; a river.

STANDARD II.

Writing.—The following passage was dictated from the reading book:—

'The threads in the stem are separated from the rest of the plant. Then they are taken to a mill, where they are combed and dressed. After that they are spun into yarn, and then they are woven into cloth.'

Arithmetic.—Two sets of sums were dictated.

A. 1. 8,137 + 69 + 458 + 19,807 + 376,014 + 378.

2. Multiply 7,109 by 890.

3. Take 4,687 from 171,015.

4. Divide 701,345 by 9.

B. 1. 7,567 + 94 + 78,978 + 369,809 + 756,917 + 28,803.

2. Multiply 8,637 by 685.

3. Take 19,117 from 304,060.

4. Divide 530,178 by 11.

Answers.—*A.* (1) 404,863; (2) 6,327,010; (3) 166,328; (4) 77,927 + 2 over.

B. (1) 1,242,168; (2) 5,916,345; (3) 284,943; (4) 48,198.

Mental Arithmetic.—How many halfpence in 2s. 6d.? I spent 6½d. out of 9d.: How many halfpence had I left? How many halfpenny articles should I get for 7½d.? for 11½d.? for 8½d.? How many days in 5 weeks? How many weeks in 21 days? I spent 4s. 9d. for penny stamps: how many did I buy? 106 oranges at 1d. each? at ½d. each? at ¼d. each? Divide 36 by 3, and then multiply by 12. How much change should I have out of a florin after paying for 8 packets of needles at 2 for 1½d.?

Geography.—Questions were asked on the map of England as—Point to a lake. Name it. Point to capes. Name them. Tell some other names for capes. What is a promontory? What is a strait? Name two straits. What do they connect? What do they separate? What is a county? What is a county town? Name your county town.

Poetry.—The piece repeated was 'Casabianca' by Mrs. Hemans.

Grammar.—The children were required to select nouns and verbs readily in order from their reading books.

STANDARD III.

Dictation.—The following passage was given from the reading book:—

'She meant that she thought him the bravest and the noblest of the men at her court. He was very learned, very wise, very polished in manners, and very generous. Even as a child he was grave and thoughtful; and, while his teachers found him a quick scholar, they were able to learn something.'

Arithmetic.—Different sets of sums were given to boys and girls. The following are specimen sets:—

Boys.—1. Add £7,115 13s. 9½d.; £689 11s. 11¾d. + £90 12s. 6d.; £73 13s. 10¼d.; £876 16s. 9¾d.

2. Take £17 19s. 11¾d. from £10,001 11s. 11¼d.

4. Add 896 to the difference between 901 and 71,006.

4. There are 476 trees to be planted in 26 gardens. If 76 are planted in one, how many may be planted in each of the remaining gardens?

Girls.—1. Divide 19,280 by 28.

2. From £956 0s. 3d. take £170 18s. 11½d.

3. Add £77 19s. 4½d.; £6,707 13s. 8¾d.; 9s. 9½d.; £782 12s. 6d.; £8 13s. 10¾d.

4. How many girls could stand round a room which measured 1300 inches round, if a space of 100 inches is occupied by the door and fireplace, and 24 inches is allowed for each girl?

Answers.—*Boys*—(1) £8,846 8s. 11¼d.; (2) £9,983 11s. 11½d.; (3) 71,001; (4) 16 trees.

Girls.—(1) 688 + 16 over; (2) £785 1s. 3½d.; (3) £7,577 9s. 3½d.; (4) 50 girls.

Mental Arithmetic.—How many weeks are in a year? How many days in February? In August? In a leap year? How much is ¼ of a sovereign? ⅓ of 10s.? How many threepences make a shilling? A half-crown? A sovereign? How many sovereigns in 32 half-crowns? How many tens in 170? In 210? How many half-dozens in 96? What will 13 couple of chickens cost at 2s. each? 3½ lbs. of butter at 1s. 8d. per lb. What change should I have out of a sovereign, after paying for the butter?

Poetry.—The piece recited in this standard was 'The Wreck of the Hesperus' by Longfellow.

Geography.—Name the principal coal fields of England. What towns are at the mouth of the Tyne? What are the Tyne towns noted for? Where is most of the coal sent? Name the seaports of Yorkshire. The seaports of Cumberland. The lakes of Westmoreland. For what are they noted? Manufacture of Lancashire? What is taken from Liverpool to Manchester? What fish are caught round the coast of England?

STANDARD IV.

Dictation—A passage was dictated from the reading book.

'If anything happens to get past the eyelashes into the eye how quickly the tears flow to wash it out. Commonly the gland, or tear factory, makes only enough tears to keep the eye a little moist; but as soon as anything gets inside the eyelids the tear factory sets to work briskly, and sends out a copious flow of tears. At the same time the winking muscle keeps moving the lids, and, generally, what is in the eye is soon washed out.'

Arithmetic.—Specimen cards:—

Boys—1. Divide £79,964 6s. 6½d. by 760.

2. Multiply £790 18s. 11½d. by 812.

3. Reduce 315 mls. 4 fur. 16 pls. 2 ft. to inches.

4. If a gentleman's yearly income is £1,500, and he saves £277 5s. out of it, what does he spend per day?

Girls.—1. Multiply £899 18s. 9¼d. by 99.

2. Divide £7,607 17s. 11½d. by 591.

3. How many sheep worth four pounds each could I get for 120 oxen worth £20 each?

4. Reduce 36,980 pints to quarters.

Answers.—*Boys.*—(1) £105 4s. 3¾d. + 434; (2) £642,249 14s. 2d. (3) 19,993,248; (4) £3 7s.

Girls.—(1) £89,093 18s. 3¾d.; (2) £12 17s. 5¼d. + 4; (3) 600 sheep; (4) 72 qrs. 1 bush. 3 pks. 2 qts.

Mental Arithmetic.—How many scores are in five gross? How many half-guineas in 3½ guineas? What part of £ is 1s. 8d.? 1s. 3d.? How many half-crown articles could I get for 2 sovereigns? What would a quart of milk a day at 4d. per quart cost for the month of June? How many half-crowns are there in £7? In £10? How many sovereigns in 200 shillings? How many pints in 15 gallons? Take 19s. 9d. from a guinea. How many minutes from 2 o'clock till half past six o'clock? 9 dozen at 1¼d. each.

Poetry.—The poem recited was 'The Inchcape Bell' by Southey.

Geography.—Name the different colonies of Australia? What are their capitals? Name the islands near Australia. What do we get from each of the Australian colonies? What is done with the carcases of sheep after they are killed and the skins are taken off?

What is the capital of Canada? Name the rivers of Canada. What towns are on them? What is Quebec noted for? What fish are found in the rivers? What is the capital of British Columbia? On what river does it stand? What large island is near British Columbia? What is its capital? What minerals are obtained? What railway runs across the country? Name the islands of Canada. The bays, productions, lakes. How is salmon sent to us from Canada?

What two parts form Scotland? What divides them? What islands are round the coasts? What are the occupations of the people of the Hebrides? What large bridge has lately been built in Scotland?

STANDARD V.

Composition.—The following story was read over, and the children were required to reproduce it:—

THE BEAUTIFUL HAND.

'Three ladies once disputed as to which of them possessed the most beautiful hand. One lady dipped hers into a clear stream; another plucked strawberries until her fingers were pink; and the third perfumed hers with violets. Just then a poor woman passed, and asked for charity. The three ladies refused her; but another woman, who sat near, gave her all she possessed. The poor woman then asked the ladies what had been the subject of their dispute. On being told she exclaimed, "Beautiful hands! Why they are all beautiful; but the most beautiful is the one that is filled with kindness to the needy." The old woman then departed, leaving the ladies to reflect on what she had said.'

Arithmetic.—Specimen cards:—

Boys.—1. Add $\frac{2}{3}-\frac{1}{5}$ to $\frac{1}{2}-\frac{1}{3}$.

2. 1,182 days at $2\frac{1}{2}$ guineas for 6 days.

3. Make a bill for:—

3 ozs. at 6s. per lb.
17 rolls at $1\frac{1}{2}$d. each.
7 quires of paper at $1\frac{1}{2}$d. per quire.
144 at 9d. per doz.

4. If in 12 days a man earns £25 more than he spends, what will he save in 30 days?

Girls.—1. What is the value of 786 dollars if 20 dollars are worth £4 3s. 4d.?

2. What is the cost of 11mls. 7 fur. 13 pls. at £1 13s. 6d. per mile?

3. Find the value of 1897 at 18s. $3\frac{1}{4}$d.

4. Make a bill for:—4 bonnets at 8s. $4\frac{1}{2}$d. each; 3 hats at 17s. 6d.; dress, material cost £2 19s. 6d., making 25s. 9d.; 9 yards of mohair at 1s. $6\frac{1}{2}$d.

Answers.—*Boys.*—(1) $\frac{13}{30}$; (2) £517 2s. 6d.; (3) 1s. $1\frac{1}{2}$d. + 2s. $1\frac{1}{2}$d. + 10$\frac{1}{2}$d. + 9s. = 13s. $1\frac{1}{2}$d.; (4) £62 10s.

Girls.—(1) £163 15s.; (2) £19 19s. 2d. + $\frac{13}{60}$; (3) £1,734 19s. $3\frac{1}{2}$d.; (4) £1 13s. 6d. + £2 12s. 6d. + £4 5s. 3d. + 13s. $10\frac{1}{2}$d. = £9 5s. $1\frac{1}{2}$d.

Mental Arithmetic.—4 dozen eggs at 8 for 4s. (£1 4s.) L. C. M. of 5, 10, 15, 20. (60). $\frac{1}{5}+\frac{1}{6}$. ($\frac{11}{30}$). Take $\frac{11}{30}$ from 3. ($2\frac{19}{30}$). 5 doz. oranges at $2\frac{1}{2}$d. for 5. (2s. 6d.) One mile of wire at 3d. a yard. (£22). Find value of $\frac{1}{144}$ of a gross. (6). 160 at 2s. a score. (16s.) If 80 lbs. of sugar cost a sovereign, what must I pay for 16 lbs. (4s.) Add one fifth and one-fourth of £1. (9s.) The carriage of 5 tons is 10s., what weight can be carried for 2s. 6d.? (1 ton 5 cwt.?

STANDARD VI.

Arithmetic.—Specimen cards:—

Boys.—1. What is $\dot{7}\dot{2}$ of 2 dys. 10 hrs. 18 min.?

2. If $\frac{5}{8}$ of an estate measure 625 acres, and the rest is divided into 4 farms, what does each farm measure?

3. Find the simple interest on £880 for $2\frac{3}{5}$ years at $3\frac{5}{8}$ per cent.

4. A room 4 yards wide and 15 feet long is covered with carpet 2 ft. 1 in. wide. What did the carpet cost at 2s. 6d. per yard?

Girls.—1. If 1 lb. cost 1s. 4d., what will 12 lbs. 2 ozs. cost?

2. Divide $(\frac{1}{6}+\frac{1}{3}-\frac{1}{2})$ by $(\frac{1}{2}+\frac{5}{6})$.

3. Reduce $\frac{22}{3}$ of 5 pls. 1 yd. to the decimal of 1 mile.

4. In what time will the simple interest on £105 12s. amount to £80 at $3\frac{1}{2}$ per cent?

Answers.—*Boys.*—(1) 1 day 18 hrs. 24 mins.; (2) $92\frac{3}{4}$ acres.; (3) £85 1s. 4d.; (4) £3 12s.

Girls.—(1) 16s. 2d.; (2) $1\frac{21}{35}$; (3) ·11875; (4) $21\frac{140}{231}$ years.

STANDARDS V.—VI.

Poetry.—The poem prepared for recitation was the lay of 'Horatius' by Lord Macaulay.

Geography.—Point to lines of latitude. What do you mean by latitude? Point to lines of longitude. What is longitude? What name is given to lines of latitude? What name is given to lines of longitude? How many motions has the earth? What causes day and night? What causes the seasons? Which is the largest country in Europe? Name the largest river in Russia. Where does it rise? Into what sea does it flow? What is it remarkable for? What kind of river is the Volga? Why is it slow? Name a fast river. Where does the Danube rise? Where does the Rhine? Name towns on the Rhine. What lake does it flow through? Why is the Danube useful to Austria? (Because the country has so little coast-line).

Music.—Division III.—

Sight Tests:—

m s l d' ta l d' t d' s fe s d' ta l s l f r t, d.

s fe f m m s l t d' r' l t d' s f r s fe s r m d.

Time Tests:—

| 1 :1 | : | 1 :1.1 | 1 : | 1 : | :1 | 1.1:1 | 1 :1 | 1 :1.1 | 1.1:1 |

| :1 :1.1 | :1 : | : :1 | 1.1:1.1:1.1 | 1 :- :- | - :1 :1 |

Ear Tests:—f s l; d' ta l: s fe s; l s f; s fe f.

Songs.—The following songs were sung in three parts:—'Down where the Bluebells grow,' 'Sailors' Chorus,' and 'Gipsy Chorus.'

Query Column.

RULES.

1. **Each correspondent is restricted to *one question*.** We should be much obliged if correspondents, who send questions for solution, would give (if possible) the required answer, and the source from which the question is obtained.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. ☞ **When a pseudonym is adopted it should be written at the end of the query, and the real name and address on a separate piece of paper.**

4. Correspondents are requested to write their queries *legibly*, and on one side of the paper only.

5. Replies will not be sent through the post.

6. Queries must reach the office *not later than the 12th of the month*, or they cannot be attended to in the following issue.

*** All communications for this column should be addressed—'*The Query Editor*,' *The Practical Teacher*, *Pilgrim Street, Ludgate Hill, London, E.C.*

Algebra.

1. HERBERTUS.—I have a number of silver pieces (francs, shillings, and dollars), of which half are francs and seven are shillings. The total value being 8,400 cents., how many silver pieces are there, a franc, a shilling, and a dollar being equivalent respectively to 19, 25, and 100 cents?

(*Naval Cadet Exam., June, 1889.*)

Let x = number of silver pieces,

Then $\frac{x}{2}$ = ,, francs,

And $\frac{x}{2} - 7$ = ,, dollars;

$$\therefore \left(\frac{x}{2} \times 19\right) + (7 \times 25) + \left\{\left(\frac{x}{2} - 7\right) \times 100\right\} = 8{,}400$$

$$\frac{19x}{2} + 175 + 50x - 700 = 8{,}400$$

$$\frac{19x}{2} + 50x = 8{,}400 + 700 - 175$$

$$19x + 100x = 8{,}925 \times 2$$

$$119x = 17{,}850$$

$$\therefore x = 150.$$

$\therefore$ Number of silver pieces = 150. Ans.

2. W. JOHNSTON.—Find the values of x, y, z, which will satisfy the algebraical equations:—

(1) $ax + by + cz = p^2$,
(2) $fx + gy + hz = q^2$,
(3) $x^2 + y^2 + z^2 = r^2$.

Let $x = vz$ and $y = tz$.

$\therefore$ From (1) and (2)

$$z = \frac{p^2}{av + bt + c} = \frac{q^2}{fv + gt + h} \quad (4)$$

$$\therefore v = \frac{q^2bt + q^2c - p^2gt - p^2h}{p^2f - q^2a}. \quad (5)$$

From (3) $z^2 = \frac{r^2}{v^2 + t^2 + 1}$;

$$\therefore \frac{q^4}{f^2v^2 + g^2t^2 + h^2 + 2fvgt + 2fvh + 2gth} = \frac{r^2}{v^2 + t^2 + 1}; \quad (6)$$

Substituting the value of v from (5) we obtain the value of t. Hence we find z, and hence x and y, but the work would be considerable and very tedious.

3. INKERMAN. — Prove that the difference between the coefficients of x^{r+1} and x^r in the expansion of $(1 + x)^{n+1}$ is equal to the difference between the coefficients of x^{r+1} and x^{r-1} in the expansion of $(1 + x)^n$. (*Todhunter*)

Since $(1 + x)^{n+1}(1 - x) = (1 + x)^n(1 - x^2)$ the coefficients of any assigned power of x will be the same whether we obtain it from the left hand or right hand expression of the identity.

In the expansion of the left hand expression the coefficient of x^{r+1} is the coefficient of x^{r+1} less the coefficient of x^r in the expansion of $(1 + x)^{n+1}$.

Similarly in the expansion of the right hand expression the coefficient of x^{r+1} less than of x^{r-1} in the expansion of $(1 + x)^n$.

Hence these two differences are equal.

Note.—The result can be obtained by direct work.

4. INQUIRER. — An annuity of 15s. 10d. to be paid every calendar month for 20 years is purchased for £100. What is the rate per cent. per annum reckoning compound interest commutable once a year?

Let A denote the annual payment in pounds, R the amount of one pound in one year, n the number of years, and P the present value of the annuity in pounds.

Then, $P = \frac{1 - R^{-n}}{R - 1} A.$

$$\therefore 100 = \tfrac{19}{4} \left(\frac{1 - \frac{1}{R^{20}}}{R - 1}\right)$$

$$\tfrac{19}{4}(R - 1) = 1 - \frac{1}{R^{20}}$$

$$200\,R - 200 = 19 - \frac{19}{R^{20}}$$

$$200\,R^{21} - 219\,R^{20} = -19$$

$$219\,R^{20} - 200\,R^{21} = 19.$$

This is not adapted for logarithmic computation, and the value of R must be found by *trial*.

Suppose the rate of interest = 5, then R = 1·05.

$$\begin{aligned} \text{Log } 1{\cdot}05^{20} &= 20 \log 1{\cdot}05 \\ &= {\cdot}0211892991 \times 20 \\ &= {\cdot}423785982 \\ &= \log 2.6534 \text{ nearly.} \end{aligned}$$

$$\begin{aligned} \text{Log } 1{\cdot}05^{21} &= 21 \log 1{\cdot}05 \\ &= {\cdot}0211892991 \times 21 \\ &= {\cdot}4449752811 \\ &= \log 2{\cdot}78596. \end{aligned}$$

$$\begin{aligned} \therefore 219\,R^{20} - 200\,R^{21} &= (2{\cdot}6534 \times 219) - (2{\cdot}78596 \times 200) \\ &= 581{\cdot}0946 - 557{\cdot}192 \\ &= 23{\cdot}9026. \end{aligned}$$

The rate of interest is, therefore, too small. Suppose the rate = 7, then R = 1·07.

$$\begin{aligned} \text{Log } 1{\cdot}07^{20} &= 20 \log 1{\cdot}07 \\ &= {\cdot}0293838 \times 20 \\ &= {\cdot}587676 \\ &= \log 3{\cdot}86968. \end{aligned}$$

$$\begin{aligned} \text{Log } 1{\cdot}07^{21} &= 21 \log 1{\cdot}07 \\ &= {\cdot}0293838 \times 21 \\ &= {\cdot}6170598 \\ &= \log 4{\cdot}14056. \end{aligned}$$

$$\begin{aligned} \therefore 219\,R^{20} - 200\,R^{21} &= (3{\cdot}86968 \times 219) - (4{\cdot}14056 \times 200) \\ &= 847{\cdot}43992 - 828{\cdot}112 \\ &= 19{\cdot}32792. \end{aligned}$$

$\therefore$ Rate of interest = 7 per cent.

5. PISGAH. — Show that if the difference of the alternate figures in a number is divisible by 11, the whole number is divisible by 11.

Let $d_0 + d_1r + d_2r^2 + \ldots\ldots + d_{n-1}r^{n-1} + d_n r_n$ be any number whose radix is r.

We can re-write the number thus—

$d_0 + d_2 + d_4 + \ldots\ldots - (d_1 + d_3 + d_5 + \ldots\ldots) + d_1(r+1) + d_3(r^2-1) + d_3(r^3+1) + \ldots\ldots + d_{n-1}(r^{n-1} \pm 1) + d_n(r^n \pm 1)$;

Now all the terms involving r are multiples of $(r+1)$;

∴ If $d_0 + d_2 + d_4 + \ldots\ldots - (d_1 + d_3 + d_5 + \ldots\ldots)$ is a multiple of $(r+1)$, the number is also.

In the ordinary notation $r = 10$.

∴ If the difference of the alternate figures in a number is divisible by $(10+1)$ or 11 the whole number is divisible by 11.

Note.—Your query gave the sum as well as the difference, and that is incorrect.

6. REX.—A man 25 years of age can insure his life for £1,000 by paying an annual premium of £18. Taking interest at 5 per cent., what will be an equitable composition for an annual subscription of £3?

Amount of insurance in second case $= £1{,}000 \div \frac{18}{25}$
$= £\frac{25}{18}0$.

Let A denote an annual premium in pounds, n the number of years, R the amount of one pound in one year, M the amount in pounds at the end of number of years, and P the present value in pounds of this amount.

Then $M = \frac{R^n - 1}{R - 1}A$,

and $P = \frac{1 - R^{-n}}{R - 1}A$;

$\therefore \frac{25}{18}n = \frac{1{\cdot}05^n - 1}{1{\cdot}05 - 1} \times 3$
$= (1{\cdot}05^n - 1) \times 60$,

$1{\cdot}05^n - 1 = \frac{25}{18}$,

$1{\cdot}05^n = \frac{25}{18} + 1$.
$= \frac{43}{18}$.

$P = \frac{1 - R^{-n}}{R - 1}A$
$= \frac{1 - \frac{1}{\frac{43}{18}}}{\frac{1}{20}} \times 3$
$= \frac{25}{43} \times 60$
$= \frac{1500}{43}$;

∴ Equitable composition $= £\frac{1500}{43}$
$= £44\ 2s.\ 4\frac{4}{43}d.$ Ans.

7. RALPHO.—A man purchases the leasehold of a house for £3,000, the ground rent being £50 per annum, and the lease having 20 years to run. He lets the house for the whole term. What annual rent should he receive to make 5 per cent. on his outlay? (*Intermediate Arts, 1882*).

Given log. 2 = 0·3010300, log. 3 = 0·4771213,
log. 7 = 0·8450980, log. 11,306 = 4·0533090,
log. 11,307 = 4·0533474.

Let A denote the annual rent without ground rent in pounds, n the number of years, R the amount of one pound in one year, and P the present outlay in pounds.

Then, $P = \frac{1 - R^{-n}}{R - 1}A$;

$\therefore 3{,}000 = \frac{1 - (\frac{21}{20})^{-20}}{\frac{1}{20}}A$,

$150 = \left\{1 - (\frac{21}{20})^{-20}\right\}A$,

Now log. $(\frac{21}{20})^{20}$ = 20 (log. 21 − log. 20)
= 20 (log. 7 + log. 3 − log. 2 − log. 10)
= 20 (·1450980 + ·4771213 − 1·3010300)
= ·0211893 × 20
= ·4237860;

log. 3 or ·4771213 − ·4237860
= ·0533353;

Now ·0533090 = log. 1·1306
·0533474 = log. 1·1307
Difference = ·0000384,

Difference between ·0533353 and ·0533090 = ·0000263,
and $\frac{263}{384} = \frac{7}{10}$ nearly,

∴ ·0533353 = log. 1·13067;

wherefore ·4237860 $= \frac{\log.\ 3}{\log.\ 1{\cdot}13067}$
$= \frac{1}{\cdot 37689}$.

∴ 150 = (1 − ·37689)A
= ·62311 A,

∴ A $= \frac{150}{\cdot 62311}$
$= £240\ 14s.\ 6\frac{11}{11}d.$

∴ Annual rent = £290 14s. 6d. Ans.

General.

1. T. D.—We believe you get marks for all the drawing subjects you have taken. Your writing has the great merits of legibility and neatness. On the other hand, you evidently hold your pen in a peculiar way: the slope of the copy is wrong, the shapes of the letters are not those most approved of, while the strokes all lack finish and grace. Why not learn to write properly? You could do so with care and practice.

2. INKERMAN.—The pious attitude of Roman Catholic peasants when the bell rang for prayer.

3. PERPLEXED.—We think so.

4. MATRIC.—(1) Bradley's Latin Prose Composition. (2) We do not know. A second elementary does not imply much. You would do well to study it again.

5. DOUBTFUL.—We don't think you need trouble about what you have done. Forget it. One thing you would do well to pay attention to that is of supreme importance—English Composition. Write plain grammatical sentences and punctuate them. You also misuse shall and will.

6. IVANHOE.—Your question would fill too much space; they are also exceedingly simple.

7. R. FISH.—By multiplying the three equations as stated, we obtain as a factor of x, y, and z the expression

$a(b'c'' - b''c') + a'(b''c - bc'') + a''(b'c - bc')$.

By referring to Arts. 213 and 210 you will notice that this expression must equal zero, if there are any other values than $x = 0$, $y = 0$, and $z = 0$.

If there are other values, then by addition as given we obtain the identity $0 = 0$.

Again, if the first and second equations be multiplied as stated and added, we obtain as factors of x, y, and z the expression

$a(b'c'' - b''c') + a'(b''c - bc'')$;

but if the whole expression = 0,

$\therefore a(b'c'' - b''c') + a'(b''c - bc'')$
$= -a''(b'c - bc')$
$= a''(bc' - b'c)$.

∴ The sum of the first and second equations is equal to the third equation.

Is it quite clear now? If not, write again.

Mensuration.

1. C. C. R.—Regular hexagons are inscribed in circles whose radii are 3 feet and 5 feet. What is the area of the circle in which the area of the inscribed hexagon is a mean proportional between the areas of the two former hexagons. ($\pi = \frac{22}{7}$.)

Area of first hexagon $= \left(3^2 \times \frac{\sqrt{3}}{4} \times 6\right)$ sq. ft.,

,, second ,, $= \left(5^2 \times \frac{\sqrt{3}}{4} \times 6\right)$ sq. ft.,

∴ ,, third ,, $= \left(3 \times 5 \times \frac{\sqrt{3}}{4} \times 6\right)$ sq. ft.,

∴ Side of third hexagon $= \sqrt{3 \times 5}$ ft.
$= \sqrt{15}$ ft.

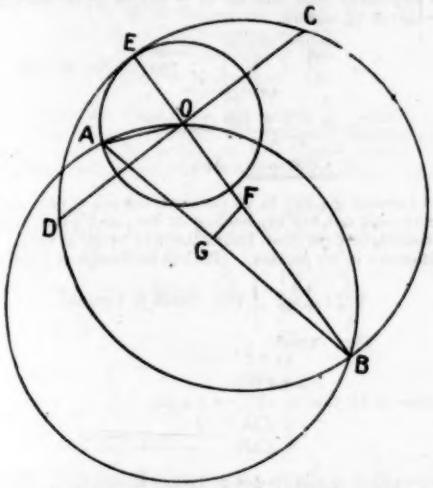
This might have been obtained at once without finding the areas.

∴ Radius of required circle = $\sqrt{15}$ ft.,

∴ Area of required circle = $(15 \times \frac{22}{7})$ sq. ft.
$= \frac{330}{7}$ sq. ft.
$= 47\frac{1}{7}$ sq. ft. Ans.

Geometry.

1. R.W.G.—From point O in the circumference of a circle the two chords OA, OB, are drawn so that the rectangle under OA and OB is equal to a given square. Prove that AB touches a fixed circle and determine its radius.



From O draw OC at right angles to OB and equal to a side of the given square.

Produce CO to D making OD = OC.

Describe a circle through B, C, D, and produce BO to meet the circumference in E.

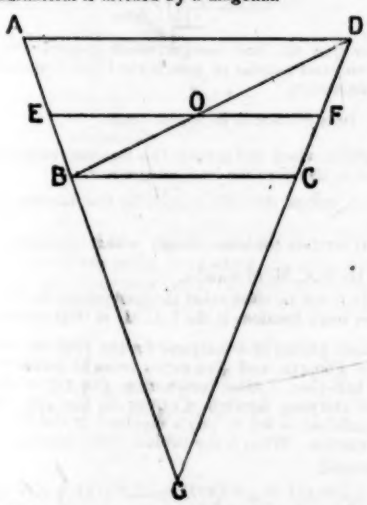
With centre O and radius OE describe a circle cutting the circumference of the first circle in A.

Then rectangle OA, OB shall be equal to the given square.

For rectangle OA. OB = rect. OE. OB, and rect. OE. OB = rect. OC, OD or square on OC or given square.

If from F the middle point of BE a perpendicular FG be drawn to AB, then AB will touch the circle drawn from centre F and radius equal to FG.

2. STANMITZ.—Show how to divide a quadrilateral, two sides of which are parallel, by a straight line which is parallel to them into two quadrilaterals, which are similar to each other, and prove that the areas of these two quadrilaterals are *respectively* equal to the areas of the triangles into which the whole quadrilateral is divided by a diagonal.



Let ABCD be a quadrilateral of which the sides AD and BC are parallel.

It is required to draw EF parallel to BC, so that the quadrilaterals AEFD and EBCF are similar.

Let BC be less than AD.

Then AB and DC will meet towards B and C,

Let them meet in G.

In GD take GF so that $GF^2 = GC.\ GD$.

Through F draw FE parallel to BC.

Then the quadrilaterals AEFD and EBCF shall be similar.

Proof.—The quadrilaterals AEFD and EBCF are evidently equiangular, and since

$$GC.\ GD = GF^2,$$
$$\therefore GF : GC = GD : GF,$$
$$GF - GC : GC = GD - GF : GF,$$
$$FC : GC = DF : GF,$$
$$FC : DF = GC : GF,$$
$$FC : DF = BC : EF,$$
$$\therefore FC : BC = DF : EF.$$

Similarly we could prove that

$$EB : BC = AE : EF,$$
$$\text{and } EB : EF = AE : AD.$$

$\therefore$ The quadrilaterals are similar.

Again, since $DF : EF = FC : BC$,

$$\text{and } DF : DC = OF : BC,$$
$$\therefore EF : DC = FC : OF,$$
$$\text{or } EF : OF = FC : DC,$$
$$EF - OF : OF = DC - FC : FC,$$
$$\therefore EO : OF = DF : FC.$$
$$\text{Again } DF : OD = DC : DF,$$
$$DF - OD : OD = DC - DF : DF,$$
$$\therefore BO : OD = FC : DF.$$

Compounding these ratios

$$EO.\ BO : OF.\ OD = DF.\ FC : FC.\ DF,$$
$$\therefore EO.\ BO = OF.\ OD.$$

$\therefore$ Triangle EOB = triangle FOD.

$\therefore$ Quadrilateral EBCF = triangle DBC, and quadrilateral AEFD = triangle ABD.

Q.E.F.

Note.—$EF^2 = AD.\ BC$, or EF is a geometrical mean between AD and BC.

Arithmetic.

1. HERBERTUS.—405 acres are to be divided between A, B, and C. A is to have 7 for every 11 that B has, and C is to have half as much again as A and B together. Find their shares. (*Naval Cadet Exam., Nov. 1889.*)

In proportion A's share = 7, B's share = 11, and C's share = $(7 + 11) \times \frac{3}{2}$ or $18 \times \frac{3}{2}$ or 27.

$$\therefore \text{A's share} = \frac{7}{7 + 11 + 27} \text{ or } \frac{7}{45} \text{ of } 405 \text{ ac.}$$
$$= (7 \times 9) \text{ ac.}$$
$$= 63 \text{ ac.;}$$
$$\text{B's share} = (11 \times 9) \text{ ac.}$$
$$= 99 \text{ ac.;}$$
$$\text{C's share} = (27 \times 9) \text{ ac.}$$
$$= 243 \text{ ac.}$$

2. J. C.—A sum of £1,640 is borrowed to be paid in two years by two equal annual payments, allowing 5 per cent. compound interest. Find the annual payment.

(*Matriculation, 1884.*)

£ 105 : £ 100 :: £ 100 : Debt for a payment of £100 the first year.

$$= £\frac{2000}{21}.$$

$5\,\%$ on £105 = £$5\frac{1}{4}$;

£ $110\frac{1}{4}$: £ 100 :: £ 100 : Debt for a payment of £100 the second year.

$$= £\frac{10000}{441}.$$

Amount of debt for two annual payments of £100

$$= \left(\frac{2000}{21} + \frac{10000}{441}\right) £$$
$$= \frac{42000 + 40000}{441} £$$
$$= \frac{82000}{441} £.$$

$\therefore$ £ $\frac{82000}{441}$: £ 1,640 :: £ 100 : Annual payment,

$$= \frac{1640 \times 100 \times 441}{82000} £$$
$$= £882. \text{ Ans.}$$

Solutions to the queries of 'Cyclops' and 'Skin' will appear in our next issue.

Owing to an accident at the moment of going to press with the diagrams ready to appear in connection with W. G.'s query—Applied Mechanics—we regret we are unable to insert the solution. If our correspondent will kindly furnish us with his name and address we shall be happy to forward a proof by post.

Certificate Examination, 1889.

Female Candidates.

SECOND YEAR.

Arithmetic.

(TWO *hours and a* HALF *allowed for this paper.*)

No candidate is permitted to answer more than TEN questions.

The *solution* must be given at such length as to be intelligible to the examiner, otherwise the answer will be considered of no value.

1. Show, from the law of Arithmetical Involution, that the squares of two numbers which differ from each other by unity, differ by the sum of the two numbers, *e.g.*, $6^2 - 5^2 = 6 + 5$. Give the reason fully.

The product of the sum and difference of two numbers = difference of their squares.

Let a and b be any two numbers, of which a is the greater.

Then $a^2 - b^2 = (a + b)(a - b)$.

If $(a - b) = 1$, it is evident that $a^2 - b^2 = a + b$.

Thus $6^2 - 5^2 = (6 + 5)(6 - 5)$
$= 6 + 5$.

2. In a certain school, 80 per cent. of the scholars examined pass in Arithmetic, one-tenth more in Writing than in Arithmetic, and one-eleventh more in Reading than in Writing. If the passes in Reading number 120, how many scholars were examined?

Percentage of passes in Writing = 80 + $\frac{1}{10}$ of 80
= 88;

" " Reading = 88 + $\frac{1}{11}$ of 88
= 96;

$$\therefore \text{Number examined} = \frac{5}{\cancel{120}} \times \frac{\overset{25}{\cancel{100}}}{\underset{4}{\cancel{96}}}$$

= 125. Ans.

3. Explain the difference between True Discount and Banker's Discount. Find the amount of a Bill due 8 months hence, if the True Discount, at 3 per cent. per annum, is £11 12s.

True discount is the interest on the present worth.

Banker's discount is the interest on the debt, that is, on the (present worth + true discount).

The banker's discount is therefore greater than the true discount by the interest on the true discount.

Amount of £100 for the given time at the given rate
= £100 + $\frac{3}{4}$ of £3
= £102;

$$\therefore \quad \begin{matrix} £ & £ & s. & & £ \\ 1 & : & 11\ 12 & :: & \cancel{102} \\ & & 51 & & 51 \end{matrix} \quad : \text{ Amount of Bill.}$$

£591 12

∴ Amount of Bill = £591 12s. Ans.

4. Reduce $\frac{105}{175}$ lbs. and $\frac{55}{101}$ qrs. each to the decimal of a cwt., and add the results together.

$$\frac{105}{175} \text{ lb.} = \frac{\overset{7}{\cancel{105}}}{275 \times \underset{4}{\cancel{112}}} \text{ cwt.}$$

$= \frac{7}{1100}$ cwt.
= ·0063 cwt.

$$\frac{55}{101} \text{ qr.} = \frac{33}{101 \times \frac{1}{2}} \text{ cwt.}$$

$= \frac{33}{101}$ cwt.
= ·16336 cwt.

·0063636363...
·1633663366...
·1697299729...

= ·16972. Ans.

5. A contractor, having undertaken to make a railway in one year, employs 750 men for 4½ months, and then finds he has done $\frac{3}{10}$ of his work. How many men must he employ for the remaining time, in order to complete his contract as agreed?

This is a question in compound proportion, and we require to know how many men will do $(1 - \frac{3}{10})$ or $\frac{7}{10}$ of the work in $(12 - 4\frac{1}{2})$ or $7\frac{1}{2}$ months.

$$\left.\begin{matrix} \text{months} & \text{months} \\ 7\frac{1}{2} & : & 4\frac{1}{2} \\ 3 & : & 7 \end{matrix}\right\} :: \begin{matrix} \text{men} \\ 750 \end{matrix} : \text{No. of men.}$$

$$= \frac{\overset{3}{\cancel{9}} \times 7 \times \overset{50}{\cancel{750}}}{\underset{3}{\cancel{15}} \times 3} \text{ men}$$

= 1,050 men. Ans.

6. I invested £4,257 in 2¾ per cent. consols at 96¼, and subsequently sold out half my holding at the same price, investing the proceeds in 5 per cent. Indian Railway Stock at 120½. Find the difference in my income. (Reckon brokerage at ¼ per cent.)

$$\begin{matrix} £ & £ & £ \\ 96\frac{1}{4} & : & 4,257 \\ 4 & & 4 \\ \overline{385} & & \overline{17028} \\ & & 44 \end{matrix} :: \begin{matrix} £ \\ 100 \end{matrix} : \text{Stock in Consols.}$$

= £4,400.

Income in 1st case = 2¾% on £4,400
= £44 × $\frac{11}{4}$
= £121.

$$\begin{matrix} £ & £ & £ \\ 120\frac{5}{8} & : & 96\frac{1}{4} \\ 8 & & 8 \\ \overline{965} & & \overline{\cancel{772}} \\ \underset{193}{\cancel{965}} & & 4 \end{matrix} :: \begin{matrix} £ \\ \cancel{2,200} \\ 440 \end{matrix} : \text{Stock in Indian Railways.}$$

= £1,760.

Income on this stock = 5% on £1,760
= £88.

∴ Difference in income = £88 − ½ of £121
= £88 − £60 10s.
= £27 10s. increase. Ans.

7. Subtract the square of 2½ from the square root of $62\frac{209}{576}$.

Difference = $\sqrt{62\frac{209}{576}} - (2\frac{1}{2})^2$
= $\sqrt{\frac{35721}{576}} - (\frac{5}{2})^2$
= $\frac{189}{24} - \frac{234}{96}$
= $\frac{777 - 648}{98}$
= $\frac{129}{98}$
= $1\frac{31}{98}$. Ans.

8. Show that the least integer which contains two or more fractions an exact number of time is the Least Common Multiple of their numerators.

Let $\frac{a}{b}$ be a fraction in its lowest terms.

The number which will contain this fraction exactly must be a multiple of a, therefore the least integer is a.

The least integer divisible exactly by the fraction $\frac{c}{d}$ is therefore c. Wherefore the least integer which contains $\frac{a}{b}$ and $\frac{c}{d}$ exactly is the L.C.M. of a and c.

Similarly it can be shown that the least integer divisible exactly by three or more fractions is the L.C.M. of their numerators.

9. The net profits of a company for the half-year just ended amount to £60,451, and £10,297 is brought forward from the previous half-year. After transferring £20,153 to the reserve fund, and carrying forward £13,095 to the next half-year's account, sufficient is left to pay a dividend at the rate of 15 per cent. per annum. What is the capital of the company?

Amount paid
= (£60,451 + £10,297) − (£20,153 + £13,095)
= £70,748 − £33,248
= £37,500;

$$\therefore \text{Capital} = £37,500 \times \frac{100}{7\frac{1}{2}}$$

= £500,000. Ans.

10. Three girls begin skipping at exactly the same moment. They jump at intervals of ·6, ·75, and ·8 seconds respectively. How long will it be before they again jump simultaneously?

Time = L.C.M. of ·6, ·75, and ·8
= L.C.M. of $\frac{6}{10}$, $\frac{3}{4}$, and $\frac{4}{5}$;
L.C.M. of Numerators = 12
G.C.M. of Denominators = 1
∴ L.C.M. of fractions = $\frac{12}{1}$
∴ Time = 12 seconds. Ans.

11. A rectangular stone basin, the bottom and sides of which are composed of slabs 3 inches thick, measures externally 8 feet in length, 2 feet 6 inches in breadth, and 3 feet in height. How many gallons will it contain? (One gallon occupies ·16 cubic feet.)

Cubical content
= (8 ft. − 6 in.) × (2 ft. 6 in. − 6 in.) × (3 ft. − 3 in.)
= $7\frac{1}{2}$ ft. × 2 ft. × $2\frac{3}{4}$ ft.
= $\left(\frac{15}{2} \times \frac{2}{1} \times \frac{11}{4}\right)$ cub. ft.
= $\frac{165}{4}$ cub. ft.;

∴ Quantity = $\left(\frac{165}{4} \times \frac{25}{\frac{100}{16}}\right)$ gals.
= $\frac{165}{4} \times \frac{4}{25}$ gals.
= $\frac{165}{25}$ gals.
= $257\frac{13}{16}$ gals. Ans.

12. The distance from London to Dover is 75 miles, from Dover to Calais 20 miles, and from Calais to Paris 180 miles, and I pay £2 17s. 6d. for my ticket. The rate per mile being by boat $2\frac{1}{2}$ times more, and by French railway $2\frac{1}{2}$ per cent. less, than by English railway, find the respective shares of the two railways and the boat company.

$\left\{75 + (20 \times 3\frac{1}{2}) + \left(180 \times \frac{100 - 2\frac{1}{2}}{100}\right)\right\}$ times cost per mile on English railway = £2 17s. 6d.,

$\left\{75 + 70 + \left(180 \times \frac{875}{\frac{1000}{5}}\right)\right\}$ times cost per mile = £2 17s. 6d.,

(145 + 175) times cost per mile = £2 17s. 6d.,
∴ Cost per mile = £2 17s. 6d. ÷ 320 = $8\frac{7}{32}$d.
∴ Cost on English railway = $(\frac{87}{32} \times 75)$d.
= $\frac{6525}{32}$d.
= $161\frac{13}{32}$d.
= 13s. $5\frac{13}{32}$d. Ans.

Cost on boat = $\left(\frac{69}{\frac{32}{16}} \times \frac{35}{70}\right)$d.
= $\frac{69}{64} \times \frac{35}{70}$d.
= $\frac{2415}{4480}$d.
= 12s. $6\frac{415}{448}$d. Ans.

Cost on French railway = $(\frac{87}{32} \times 175)$d.
= $\frac{15225}{32}$d.
= $377\frac{17}{32}$d.
= £1 11s. $5\frac{17}{32}$d. Ans.

13. In a race of 100 yards, A allows B 4 yards and C 6 yards start, in order that they may reach the goal at the same time. How much start should B allow C when B has to run the whole distance?

While B runs (100 − 4) yds. or 96 yds., C runs (100 − 6) yds., or 94 yds.;
B can allow C 2 yds. in 96 yds.,
∴ B should allow C a start of 100 yds. × $\frac{2}{96}$
= $\frac{100}{48}$ yds.
= $\frac{25}{12}$ yds.
= $2\frac{1}{12}$ yds. Ans.

14. A life policy for £2,000 is effected in 1866 by payment of a single premium of £52 10s. per cent., and the claim is made in 1888. What profit is made by an insurance company which obtains $3\frac{1}{2}$ per cent. for its investments, it being given that at this rate of compound interest money doubles itself in 20 years?

Duration of policy = 22 years.

Amount of £52 10s. in 20 years = £52 10s. × 2
= £105,
Amount in 21 years = £105 × $\frac{103\frac{1}{2}}{100}$
= $\frac{21 \times 207}{40}$ £,
,, 22 years = $\frac{21 \times 207 \times 207}{40 \times 200}$ £
= $\frac{8\,98\,83\,3}{8\,00\,00}$ £
= £112$\frac{8}{8}\frac{98}{00}$;
Gain per cent. = £12$\frac{83}{800}$,
∴ Total gain = £12$\frac{83}{800}$ × 20
= £240 + £9$\frac{83}{80}$
= £249 11s. $5\frac{1}{2}$d. Ans.

15. Say what arithmetical truths are expressed in the following formulæ. Prove three of them, and give a numerical example of each:—

(i.) If x is $\frac{a}{b}$ of y; y is $\frac{b}{a}$ of x.

(ii.) If $a : b :: c : d$, then $a : c :: b : d$ and $ad = cb$, and $a^2 : b^2 :: c^2 : d^2$.

(iii.) $a - b = (a + n) - (b + n)$.

(iv.) $\frac{a}{b}$ is less than $\frac{a + c}{b}$, but greater than $\frac{a}{b + c}$.

(v.) $\frac{a}{b} = \frac{an}{bn} = \frac{a \div n}{b \div n}$.

(vi.) If a is a measure of b and also of c; it is a measure of $b + c$: of either $b - c$, or $c - b$, and also of nb and nc.

(i.) If one magnitude is a fraction of another magnitude, the relation of the second magnitude to the first is the reciprocal of that fraction.

If $x = \frac{a}{b}$ of y
$x = \frac{ay}{b}$
$bx = ay$
$ay = bx$
$\therefore y = \frac{bx}{a}$
$= \frac{b}{a}$ of x.

Example:—6 is $\frac{2}{3}$ of 9,
∴ 9 is $\frac{3}{2}$ of 6.

(ii.) (*a*) If four quantities are proportionals, they are proportionals when taken *alternately*.

If $a : b :: c : d$,
Then $\frac{a}{b} = \frac{c}{d}$,
Multiplying by $\frac{b}{c}$ } $\frac{a}{b} \times \frac{b}{c} = \frac{c}{d} \times \frac{b}{c}$,
$\frac{a}{c} = \frac{b}{d}$
$\therefore a : c :: b : d$.

Example:—4 : 12 :: 3 : 9,
and 4 : 3 :: 12 : 9.

(*b*) When four quantities are proportionals, the product of the extremes is equal to the product of the means.

If $a : b :: c : d$,
Then $\frac{a}{b} = \frac{c}{d}$
$\frac{a}{b} \times bd = \frac{c}{d} \times bd$
$\therefore ad = bc$.

Example:—4 : 12 :: 3 : 9,
$\therefore 4 \times 9 = 12 \times 3$.

(c) If four quantities are proportionals, the squares of these quantities are proportionals.

If $a : b :: c : d$,

Then $\frac{a}{b} = \frac{c}{d}$,

$\therefore \left(\frac{a}{b}\right)^2 = \left(\frac{c}{d}\right)^2$,

$\frac{a^2}{b^2} = \frac{c^2}{d^2}$,

$\therefore a^2 : b^2 :: c^2 : d^2$.

Example :— $4 : 12 :: 3 : 9$,
Then $4^2 : 12^2 :: 3^2 : 9^2$,
or $16 : 144 :: 9 : 81$,
or $1 : 9 :: 1 : 9$.

(iii.) The difference between two quantities is not altered by adding the same quantity to each.

Let $a - b = x$,
Then $a - b + n - n = x$,
$a + n - b - n = x$,
$(a + n) - (b + n) = x$,
$\therefore a - b = (a + n) - (b + n)$.
Example :— $9 - 7 = (9 + 3) - (7 + 3)$.

(iv.) A fraction is increased by increasing the numerator, and diminished by increasing the denominator.

(a) The fraction $\frac{a}{b}$ is less than $\frac{a + c}{b}$,

For $\frac{a + c}{b} = \frac{a}{b} + \frac{c}{b}$.

$\therefore \frac{a}{b}$ is less than $\frac{a + c}{b}$.

Example :— $\frac{1}{2}$ is less than $\frac{3 + 2}{8}$ or $\frac{5}{8}$.

(b) The fraction $\frac{a}{b}$ is greater than $\frac{a}{b + c}$,

For the parts in $\frac{a}{b + c}$ are less than the parts in $\frac{a}{b}$, as unity is divided into more parts, and the same number are taken,

$\therefore \frac{a}{b}$ is greater than $\frac{a}{b + c}$.

Example :— $\frac{3}{4}$ is greater than $\frac{3}{8 + 2}$ or $\frac{3}{10}$.

(v.) A fraction is unaltered if the numerator and denominator be both multiplied or divided by the same number.

(a) If the numerator of the fraction $\frac{a}{b}$ be multiplied by n, the fraction becomes $\frac{an}{b}$, or n times as much; if the denominator be now multiplied by n, the fraction becomes $\frac{an}{bn}$, or the nth part of it, and it is therefore equal to the original fraction, viz. $\frac{a}{b}$.

$\therefore \frac{a}{b} = \frac{an}{bn}$.

Example :— $\frac{3}{4} = \frac{3 \times 2}{8 \times 2}$.

(b) If the numerator of the fraction $\frac{a}{b}$ be divided by n, the fraction becomes the nth part of $\frac{a}{b}$; if the denominator be now divided by n, the fraction becomes n times as much, and it is therefore equal to the original fraction, viz. $\frac{a}{b}$.

$\therefore \frac{a}{b} = \frac{a \div n}{b \div n}$.

Example :— $\frac{8}{16} = \frac{6 \div 2}{16 \div 2}$.

(vi.) If a quantity measures two others, it will also measure their sum, difference, and any multiples of them.

(a) Let $b = ma$,
and $c = na$,
Then $(b + c) = ma + na$
$= (m + n)\, a$.
$\therefore a$ measures the sum of $b + c$,
$(m + n)$ times.
Example :—6 measures 18 and 30.
$18 + 30 = 48 = 6 \times 8$.

(b) Let $b = ma$,
and $c = na$,
and let b be greater than c,
Then $b - c = ma - na$
$= (m - n)\, a$.
$\therefore a$ measures $b - c$, $(m - n)$ times.
Let c be greater than b,
Then $c - b = na - ma$
$= (n - m)\, a$.
$\therefore a$ measures $c - b$, $(n - m)$ times.
Example :—6 measures 18 and 30,
$50 - 18 = 12 = 6 \times 2$.

(c) Let $b = ma$,
Then $nb = mna$;
$\therefore a$ measures nb, mn times.
Similarly it can be shown that a measures nc.
Example :—6 measures 18,
$\therefore 6$ „ 18×3 or 54 or 6×9.

(To be continued.)

Model Answers to Pupil Teacher Examination Papers.

19TH APRIL, 1890.

END OF FIRST YEAR.

FIRST PAPER.

(Three hours and a half allowed.)

Arithmetic.

BOYS ONLY.

(Do three questions only, including Question 4, if you can).

1. Reduce $\frac{1}{16}\frac{2}{8}\frac{3}{0}\frac{2}{8}$ to its lowest terms, and subtract $3\frac{7}{15} + 2\frac{1}{4}$ from $3\frac{1}{2} + 1\frac{5}{16} + 4\frac{3}{80}$.

2. Divide 176·47812 by ·000252, and express ·176 ÷ 1·76 as a decimal.

3. Subtract $\frac{1}{12}$ of £8 1s. 2d. from ·0125 of £813 7s. 6d.; and find by what decimal the result must be multiplied to produce £10 9s.

4. Find the difference between 3·06$\dot{9}\dot{3}$ of 16s. 1cd. and ·64$\dot{1}\dot{6}$ of £2.

Prove the rule for 'pointing' in multiplication of decimals.

(1)

16632)19656(1
16632
3024)16632(5
15120
1512)3024(2
3024

$\frac{1}{16}\frac{2}{8}\frac{3}{2}\frac{2}{8} = \frac{11}{12}$. Ans.

$(3\frac{1}{2} + 1\frac{5}{16} + 4\frac{3}{80}) - (3\frac{7}{15} + 2\frac{1}{4})$

$= \left(8\,\frac{64 + 25 + 12}{80}\right) - \left(5\,\frac{28 + 55}{60}\right)$

$= 9\frac{7}{10} - 6\frac{23}{60}$

$= 2\,\frac{303 - 92}{240}$

$= 2\frac{211}{240}$. Ans.

(2) ·000252)176·478120(700310
1764
781
756
252
252
0

·175 ÷ ·176
$= \frac{175}{1000} \times \frac{1000}{176}$
$= \frac{176 \times 99}{17500}$
$= \frac{174{\cdot}24}{175}$ (Div. by 25)
$= \frac{6{\cdot}9696}{7}$
$= ·9956\frac{5}{7}1428$. Ans.

(3)
(·0125 of £813 7s. 6d.) − ($\frac{1}{16}$ of £8 1s. 2d.)
(·0125 = $\frac{1}{80}$)
= £10 3s. 4½d. − £7 11s. 1½d.
= £2 12s. 3d. Ans.

£10 9 0
£ 2 12 3 = 4. Ans.

(4)
3·0693 of 16s. 10d. − ·6416 of £2.
$= \left(\frac{30693}{9999} \times \frac{202}{240}\right) - \frac{5775}{9000} \times 2$
$= \frac{11}{12} - \frac{77}{60}$
$= \frac{155 - 77}{60}$
$= \frac{78}{60}$
$= £1{\cdot}3 = £1$ 6s. Ans.

Since $\frac{1}{10} \times \frac{1}{10} = \frac{1}{100}$
and ·6 = $\frac{6}{10}$ and ·4 = $\frac{4}{10}$
$\therefore \frac{6}{10} \times \frac{4}{10} = \frac{24}{100}$
But $\frac{24}{100}$ ·24.
$\therefore$ ·6 × ·4 = ·24.

GIRLS ONLY.

(*Do three questions only, including Question 4, if you can.*)

1. A woman has to pay four bills; the butcher's, for 13 lbs. of meat at 11½d. per lb.; the grocer's, for 12 lbs. of sugar at 2¾d. per lb., and 1½ lbs. of tea at 2s. 7½d. per lb.; the milkman's, for 7 quarts of milk at 3¾d. per quart; and the baker's, for 9½ quartern loaves at 5½d. per loaf. Make out the account for the whole and find the sum remaining out of £1 10s. which she had in her purse.

2. Find, *by Practice*, the value of 37 yards 2 ft. 9 in. at £13 1s. for every 3 yards.

3. Simplify the fraction $3\frac{3}{7} - 5\frac{2}{3} + 9\frac{1}{14} - 6\frac{3}{8} + 11\frac{1}{24}$.

4. Find the greatest common measure of 2261 and 3213 and *prove* by the steps of your working that no other number can be the greatest common measure.

(1) London, April 19th, 1890.

13 lbs. meat, at 11½d.	0	12	5½
12 lbs. sugar, at 2¾d.	0	2	9
1½ lb. tea, at 2s. 7½d.	0	3	11¼
7 qts. milk, at 3¾d.	0	2	2¼
9½ loaves, at 5½d.	0	4	4¼
	£1	5	8¼

£1 10s. − £1 5s. 8¼d. = 4s. 3¾d. Ans.

(2)

	£	s.	d.	
	3)13	1	0	
1 ft. = ⅓ yd.	4	7	0	per yard.
		37		
	160	19	0	for 37 yards.
1 ft. = ⅓ yd.	1	9	0	for 1 foot.
9 in. = ¼ yd.	1	9	0	for 1 foot.
	1	1	9	for 9 in.
	£164	18	9	for 37 yds. 2 ft. 9 in. Ans.

(3) $3\frac{3}{7} - 5\frac{2}{3} + 9\frac{1}{14} - 6\frac{3}{8} + 11\frac{1}{24}$
$= 12\frac{144 - 168 + 88 - 42 + 63}{192}$
$= 12\frac{85}{192}$. Ans.

(4) 2261)3213(1
2261
952)2261(2
1904
357)952(2
714
238)357(1
238
119)238(2
238
...

Any number which divides each of two others divides also (1) their sum, (2) their difference, and (3) the sum and difference of any multiples of the numbers.

Therefore the greatest common measure of 2261 and 3213
= the G.C.M. of 952 and 2261
= ,, 357 and 952
= ,, 238 and 357
= ,, 119 and 238.

As 119 is the greatest number which will divide 119 and 238 it is the G.C.M. of 2261 and 3213.

Grammar.

BOYS AND GIRLS.

(*Answer Questions 1 and 2, and one other question.*)

1. Say how many sentences there are in this verse, and point out the subject and predicate of each:—

And *out again I* curve and *flow*
To join the brimming *river*;
For men *may come*, and men may go,
But I go *on* for *ever*.

2. Parse the words printed in italic in the above verse.

3. What is the plural of each of the following words:—

Brother.	Sow.	Calf.	Sheep.
Ellipsis.	Penny.	Memorandum.	

4. What are (1) Abstract nouns; (2) Relative pronouns; (3) Transitive verbs? Give two examples of each and place them in sentences.

5. What is meant by the *agreement* of one word with another? Give any rule of syntax about agreement, and illustrate it by examples.

(1) Five.

(*a*)	*Sub.*	I.	*Pred.*	curve.
(*b*)	,,	[I].	,,	flow.
(*c*)	,,	men.	,,	may come.
(*d*)	,,	men.	,,	may go.
(*e*)	,,	I.	,,	go.

(2)
out—adv. of place, mod. *curve*.
again—adv. of time, mod. *curve*.
I—pers. pro., neut., sing., 1st, nom. to *curve*.
flow—reg., intrans. verb, act., ind., pres., 1st sing., agreeing with its nom. *I* understood.
to—particle, sign of inf. mood.
to join—verb, reg. trans., act., inf., gov. by *flow*.
river—noun. com., neut., sing., 3rd, obj. gov. by *to join*.
for—cop. conj., joining the sents. 'I flow' and 'Men may come.'
may—verb, aux. to *come*, indicating potential mood.
come—verb, irreg. intrans., inf. gov. by *may*.
may come—verb, irreg. intrans., act., pot., pres., 3rd plural, agreeing with its nom. *men*.
but—disj. conj. joining the sents. 'Men may go,' and 'I go.'
on—adv. of place, mod. *go*.
ever—adv. used as a com. noun, neut., sing., 3rd, obj. gov. by *for*.

(3)

Sing.	*Plural.*
Brother.	brothers, brethren.
Ellipsis.	ellipses.
Sow.	sows, swine.
Penny.	pennies, pence.
Calf.	calves.
Memorandum.	memoranda.
Sheep.	sheep.

(4) (*a*) *Abstract nouns* are the names of such things as we can only conceive of in our minds as having an independent existence, as cleanliness, thought.

(*b*) *Relative pronouns* are words which in addition to being substitutes for nouns relate to some noun or pronoun previously named. They also unite a subordinate to a principal sentence, as who, which.

Examples :—

(*a*) *Cleanliness* is next to *godliness.*
Evil is wrought by want of *thought.*
(*b*) He asked me *which* I meant.
The man told him *who* I was.

(5) *Agreement* is the law of grammar which requires that one word should take the same gender, number and person, or the same number and person as another.

Rules :

A verb agrees with its nominative in number and person, as : The king rules over a large country. *King* and *rules* are both third person and singular number.

A pronoun agrees with the noun for which it stands in gender, number and person, as: The man said he must now go away. *Man* and *he* are both masculine gender, singular number and third person.

Geography.

BOYS AND GIRLS.

(*Answer three questions only, and include* 1 *or* 5.)

1. Draw a map of
(*a*) Ireland ;
or (*b*) New South Wales ;
or (*c*) Canada, east of the Rocky Mountains.

2. Name four of the principal ports of England, Scotland, and Ireland respectively; point out their positions and their chief exports.

3. Describe the course of the Canadian Pacific Railway, and show how it shortens the route from England to the West of Australia.

4. Where are Melbourne, Perth, Bathurst, Baffin Bay, Mount Hooker and Labrador?

5. Explain how the commerce and navigation of the rivers Tay, Shannon, Tyne, Mersey, and Severn are determined by the nature of their basins.

(2) *England:* London, Liverpool, Hull, Newcastle.

London stands on the Thames, 60 miles from its mouth. Its exports consist of almost every kind of manufactured goods which England produces.

Liverpool, on the Mersey, exports cotton goods, chemicals, and machinery.

Hull, on the Humber, woollen goods, coals, iron goods, machinery.

Newcastle, on the Tyne, exports coal, chemicals, engines, and machinery.

Scotland: Glasgow, Greenock, Leith, Dundee.

Glasgow, on the Clyde, exports cotton goods, iron goods, coal, chemicals, machinery.

Greenock, on the Clyde, same as Glasgow.

Leith, on the Forth, linen, woollen, coal, agricultural produce (to England).

Cork, on Cork Harbour, South Ireland, cattle and agricultural produce.

Belfast, on Belfast Lough, linen, spirits, agricultural produce.

Waterford, on Waterford Harbour, agricultural produce.

Limerick, on Shannon, agricultural produce.

(3) The Canadian Pacific Railway with its connections extends from Quebec on the St. Lawrence to New Westminster on the Pacific coast. It passes through Montreal and Ottawa to the northern shores of Lakes Huron and Superior, which it skirts. Then it goes through Winnipeg in Manitoba, and almost due westward to the Rocky Mountains, which it crosses near Mt. Brown at a height of nearly 6,000 feet. In a winding south-westerly direction it descends rapidly into the plain of the Fraser River, and ends at New Westminster. By crossing the Atlantic and the continent, a passage to Australia can be made in about 14 days' shorter time than by the Suez Canal or the Cape of Good Hope, the distance being less, and the rate of travel greater.

(4) *Melbourne*, capital of Victoria, Australia, about nine miles from the mouth of the Yarra Yarra, which enters the bay of Port Philip.

Perth, about 12 miles up the Swan River, from Freemantle, Western Australia. Also a city on River Tay, Scotland. Also a town on River Tay, Ontario, Canada.

Bathurst, on Macquarie River, about 100 miles from Sydney, New South Wales. Also a seaport of West Africa, on River Gambia.

Baffin Bay, large opening on N.E. coast of North America, west of Greenland.

Mount Hooker, 16,000 ft. high, one of the highest peaks of the Rocky Mountains, British Columbia.

Labrador, a large province of the Dominion of Canada, north of the Gulf of St. Lawrence, and between Hudson Bay and the Atlantic Ocean.

(5) The source and the basin of the *Tay* are elevated ; the stream is therefore rapid, and the commerce confined to the mouth.

The *Shannon* has a very slow course, the country is very flat, the river is in many places broad and shallow. Above Limerick it has falls, and the commerce is thus confined to Limerick and the small places nearer the sea.

The basin of the *Tyne* includes large coal fields and lead mines. The exports of the river thus include coal and machinery. It is navigable for only about 12 miles.

The *Mersey* is only a small river, but it embraces the south Lancashire coal-field, Manchester and other cotton towns, Warrington and St. Helen's, iron and chemical towns. Hence the nature of its exports. Its commerce is almost confined to Liverpool, owing to sandbanks.

The *Severn* is a rapid river and has a wide estuary with a strong tide. It has trade as far as Worcester.

Penmanship.

BOYS AND GIRLS.

Write in large hand the word '*Possibility,*' and in small hand '*A gown made of the finest wool.*'

SECOND PAPER.

(*Two hours and a half allowed.*)

Needlework.

GIRLS ONLY.

(*One hour allowed for this exercise.*)

Set in a calico patch (2 inches square), complete not less than half of it on both right and wrong sides.

Cast on 21 stitches, knit as for the back of a stocking, showing 2 decreasings.

History.

BOYS AND GIRLS.

(*Answer three questions only.*)

1. The Roman roads and walls in Britain. Say with what special object any of these were made, and give the names of six Roman military stations.

2. What instances can you give of intercourse between England and Pope the after 500 A.D. ? What were the purposes and the results of such intercourse ?

3. Under what kings were the kingdoms of Northumbria and Mercia respectively prominent? Point out the boundaries of both kingdoms at their fullest extent.

4. Point out the special circumstances most worthy of record in the history of three of the following: Athelstan, Offa, Godwin, Bede, Augustine.

5. Write a short account of the reign of Edward the Confessor.

(1) The Roman *roads* were made for civil and military purposes, to give easy and ready access to any part of Britain, and to unite the various seats of government in the provinces.

The *walls* were built to prevent incursions of the natives from the parts unsubdued. Such were the chain of forts and wall of Antoninus between the Forth and the Clyde, and the earthen wall of Hadrian and stone wall of Antoninus between the Tyne and Solway.

Of the military stations, afterwards to become cities and towns with all the privileges of Roman citizenship, Verulam, York, Colchester, Bath, Gloucester, London, Chester, Lincoln and Cambridge, were the chief.

(2) Pope Gregory sent missionaries to England in 597 to convert England to Christianity. Augustine attempted to establish the authority of the Pope over the British Bishops, 607, in the matters of computation of Easter, the baptismal rite, and the method of preaching to the Saxons.

In 670 Eyfrid quarrelled with Wilfred, Archbishop of York. Then the first appeal was made to Rome, and a papal decree from Rome came in Wilfred's favour.

In 854 Alfred was in Rome, and the pope, Leo IV., bestowed on him his blessing.

In 1066 the pope gave his sanction to the invasion of England by William, Duke of Normandy.

(3) Mercia was most powerful under Ethelbald (716—755). His power extended over all England south of the Humber (not including Wales and Cornwall). In 736 he signed himself 'King of Britain.' Offa (794) was also very powerful.

Edwin, king of Northumbria, was the fifth Bretwalda in 617. During his reign Northumbria was at its highest pitch of greatness. It then occupied the whole of the north eastern part of Britain, from the Humber to the Forth.

(4) *Athelstan.* His subjugation of Cornwall and Wales; battle of Brunanburgh.

Offa. Subjugation of Sussex, Kent, and East Anglia; the building of Offa's Dyke from the Severn to the Wye.

Godwin. His government of Wessex, Sussex, and Kent; the quarrel with Eustace of Boulogne; the march to Gloucester; the exile and return.

Bede. His teaching, writings, and translation of the Scriptures.

Augustine. His entry into Britain; his attempt to establish the papal supremacy over the British priests.

(5) *Edward the Confessor* ascended the throne in 1042. Being a weak ruler, probably of weak intellect, the kingdom fell into the hands of a number of nobles, Godwin being chief. He confiscated his mother's lands, and then brought over a number of French, whom he placed into all the best of the public offices. This angered the nobles and many of the friends of Eustace, the king's brother-in-law, were killed at Dover. As Earl Godwin refused to punish the rioters, he was cited to appear, but Godwin raised forces and marched then to Gloucester. The matter was settled by Godwin going into exile for a time. In a year they returned in force, Edward accepted Godwin's explanations, and the French were outlawed. Quarrels took place in Northumbria and Wales, Harold assisting his brother Tostig to regain Northumbria. Edward built Westminster Abbey. He died in 1066.

Composition.

[The passage was read *twice* distinctly, and then the substance was to be written down from memory.]

A good story is told of Judge Kent, the well-known American jurist. A man was indicted for burglary, and the evidence on the trial showed that his burglary consisted in cutting a hole through a tent in which several persons were sleeping, and then inserting his head and arm through the hole, and abstracting various articles of value. It was claimed by his counsel that, inasmuch as he never actually entered into the tent with his whole body, he had not committed the offence stated, and must therefore be discharged. Judge Kent, in reply to this plea, told the jury that if they were not satisfied that the whole man was involved in the crime, they might bring in a verdict of guilty against so much of him as was thus involved. The jury, after a brief consultation, found the right arm, the right shoulder, and the head of the prisoner guilty of the offence of burglary. The judge sentenced the right arm, the right shoulder and head to imprisonment with hard labour in the state prison for two years; remarking that, as to the rest of the man's body, he might do with it what he pleased.

END OF SECOND YEAR.

FIRST PAPER.

(Three hours and a half allowed.)

Euclid.

BOYS ONLY.

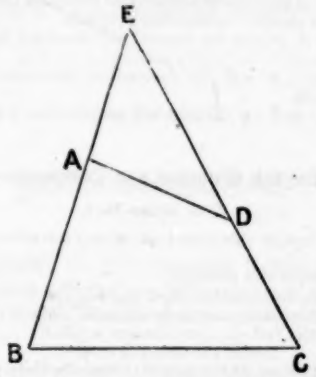
[All generally understood abbreviations and symbols for words may be used, but not symbols of operation, such as −, +, ×.]

(Answer two questions, including Question 3, if you can do so.)

1. To draw a straight line at right angles to a given straight line, from a given point in the same.
Euclid, Book I., Prop. 11.

2. At a given point in a given straight line, to make a rectilineal angle equal to a given rectilineal angle.
Euclid, Book I, Prop. 23.

3. In a quadrilateral, if two opposite sides which are not parallel are produced to meet one another, show that the perimeter of the greater of the two triangles so formed is greater than the perimeter of the quadrilateral.



3. Let the two sides BA, CD of the quadrilateral ABCD be produced and meet at E. Then the perimeter of the △ EBC is greater than the perimeter of the quadrilateral.

For the two sides AE, ED of the △ AED, are together greater than the third side AD, the fourth side of the quadrilateral (I. 20).

To each of these add the lines AB, BC, CD.

Then EA, AB, BC, CD, DE, that is EB, BC, CE, are greater than AB, BC, CD, DA. Q.E.D.

Arithmetic.

GIRLS ONLY.

(Do three questions only, including the last, if you can.)

1. After cutting away $\frac{3}{17}$ of a cake and $\frac{5}{8}$ of the remainder, there is left $3\frac{1}{2}\frac{1}{4}$ lbs.; what was the weight of the whole cake?

2. Find the value of $3\frac{3}{4}$ of £7 12s. 3d. + $5\frac{1}{2}\frac{1}{4}$ of £1 2s. 9d. − $5\frac{1}{1}\frac{3}{6}$ of £3 3s. $8\frac{3}{4}$d.

3. Divide the sum of the greatest and least of the fractions $\frac{3}{7}\frac{3}{8}$, $\frac{1}{4}\frac{4}{7}\frac{9}{6}$, $\frac{3}{1}\frac{0}{4}\frac{9}{1}$, by $\frac{5}{8}$ of the intermediate fraction.

4. Reduce to decimal fractions $\frac{3}{8}$, $\frac{1}{5}\frac{3}{2}$, $\frac{1}{3}\frac{1}{2}\frac{5}{5}$; and state the principle according to which all vulgar fractions with denominators 640, 800, 3125, will produce terminating decimal fractions.

(1) $1 - \frac{3}{17} = \frac{1}{1}\frac{4}{7}$ lbs. left after first cutting.
$\frac{1}{1}\frac{4}{7} - \frac{5}{8}$ of $\frac{1}{1}\frac{4}{7} = \frac{7}{1}\frac{4}{7}$ lbs. after second cutting.
Then $\frac{4}{1}\frac{7}{7} : \frac{1}{1}\frac{4}{7} :: 3\frac{1}{2}\frac{1}{4} : x$.
$\therefore x = \frac{1}{4}\frac{7}{7} \times \frac{3}{1}\frac{5}{4}\frac{1}{4}$
$= \frac{4}{8}\frac{1}{8} = \underline{13\frac{3}{4}}$ lbs. Ans.

(2.) Add $3\frac{3}{7}$ of £7 12s. 3d. = $\frac{3}{7}\frac{4}{8}$ of £7 12s. 3d.
= 24 × £1 1s. 9d. = £26 2 0
$5\frac{1}{1}\frac{3}{6}$ of £1 2s. 9d. = $\frac{7}{1}\frac{3}{8}$ of £1 2s. 9d.
= 76 = 1s. 9d. = 6 13 0
£32 15 0
Subtract $5\frac{1}{1}\frac{3}{6}$ of £3 3s. $8\frac{3}{4}$d. = $\frac{1}{1}\frac{0}{6}\frac{8}{8}$ of £3 3s. $8\frac{3}{4}$d.
= 108 × 3s. $4\frac{1}{4}$d. = 18 2 3
Ans. £14 12 9

(3) $\frac{4975}{159}$, $\frac{4975}{5}$, $\frac{4975}{9}$
Factors = 159 . 5 . 3 . 9.
L. C. M. = 159 × 5 × 9.
$\frac{2457,\ 2445,\ 2530}{159 \times 5 \times 9}$
Greatest and least = second and third.

$$\frac{4975}{159 \times 5 \times 9} \div \frac{3}{7} \text{ of } \frac{13}{91}$$
$$= \frac{4975}{159 \times 5 \times 9} \times \frac{7}{3} \times \frac{795}{273}$$
$$= \frac{35525}{7371}$$
$$= 5\frac{1310}{7371}. \quad \text{Ans.}$$

(4)
$\frac{7}{8} = \underline{\cdot 875}$
$\frac{15}{64} = \frac{15 \cdot 875}{8} = \underline{\cdot 234375}$
$\frac{11}{27} = \frac{3 \cdot \dot{6}}{9} = \underline{\cdot \dot{4}0\dot{7}}$. Ans.

The factors of 10 are 2 and 5. Any number whose factors are made up of these three numbers, or powers of these numbers, will therefore produce terminating decimals.

640 = 10 × 2^6 and the decimal will terminate in 7 figures at the furthest.

800 = 100 × 2^3 and the decimal will terminate in 5 figures at the furthest.

3125 = 5^5 and the decimal will terminate in 5 figures at the furthest.

English Grammar and Composition.

BOYS AND GIRLS.

(*Answer Questions* 1 *and* 2, *and two others.*)

1. Paraphrase this passage :—

By torch and trumpet *fast* arrayed
Each horseman drew his *battle* blade,
And furious every charger *neighed*
To join the dreadful revelry.
Then *shook* the hills with thunder riven ;
Then rushed the steed to battle driven ;
And *louder than* the bolts of heaven
Far flashed the red artillery.

2. Analyse the last four lines and parse the words printed in italic.

3. What is meant by *Gender* in Grammar. Give some examples of a change in gender (1) by altering the form of the word, (2) by adding a syllable, and (3) by prefixing a whole word. Give the feminine of the following words :—

Drake. Giant. Horse. Sir. Hero. Emperor. Testator.

4. Say what is the significance of each of the syllables printed in italic in the following words, and give in each case two other words similarly formed :—

*Im*proper. *Re*fix. Instruc*tion*. Audi*ble*. *Sub*marine.
*Per*forate. *E*volve. *Non-con*formist. Longi*tude*.

5. Name the Interrogative pronouns, and give examples of the use of each.

(1) Having been called together by the sound of the trumpet and the light of the brand, each horseman drew his sword to prepare for battle, while the horses neighed loudly to be ridden into the fray. Then the noise of the cannon seemed to rend the hills, the horses rushed madly forward, and the roar of the artillery was louder than the thunder.

(2) (*a*) Then shook the hills with thunder riven.
(Princ. sent.)
Subj. and enlargements : the hills riven with thunder.
Pred. : shook.
Ext. of pred. : then (time).
(*b*) Then rushed the steed to battle driven.
(Princ. sent., co-ord. with *a*.)
Subj. and enlargements : the steed driven to battle.
Pred. : rushed.
Ext. of pred. : then (time).
(*c*) And louder ... Far flashed the red artillery.
(Princ. sent., co-ord. with *a* and *b*.)
Connective : And.
Subj. and enlargements : the red artillery, louder.
Pred. : flashed.
Ext. of pred. : far (place).
(*d*) Than the bolts of heaven [are loud].
(Adv. sent. of manner.)
Connec. : Than.
Subj. : the bolts of heaven.
Pred. : are loud.
Fast—adv. of time, qualg. *arrayed*.
each—distrib. numl. adj., qualg. *horseman*.
horseman—noun, com., masc., sing., 3rd., nom. to *drew*.
battle—noun used as adj., qualg. *blade*.
neighed—verb, intrans., reg., ind., past, 3rd sing., agreeing with its nom. *charger*.
shook—verb, irreg., intrans., act., ind, 3rd, plural, agreeing with its nom. *hills*.
louder—adj. of qual., compar. deg., qualg. *artillery*.
than—cop. conj., joining the two sents., The red artillery louder, &c., and The bolts of heaven are loud.

(3) *Gender* is the change in the form of a word to denote a change of sex, as :—

(1) Tooth, teeth ; goose, geese ; mouse, mice. (2) hero, heroine ; actor, actress ; executor, executrix ; margrave, margravine ; fox, vixen. (3) he-goat, she-goat ; man-servant, maid-servant.

Drake, duck ; giant, giantess ; horse, mare ; sir, madam ; hero, heroine ; emperor, empress ; testator, testatrix.

(4)
Im—not ; imperfect, impossible.
re—again ; rebuild, reprint.
per—through ; permeate, percolate.
e—out ; emit, emerge.
non—not ; non-juror, nonentity.
sub—under ; subject, subtract.
tion—state ; education, emulation.
ble—that which may be ; readable, eligible.
tude—state ; beatitude, latitude.

5. Who, which, what, and their compounds whoever, whichever and whatever, and whether. Examples : Who is that man? Which do you mean? What do you want? Whether of them twain did the will of his father? Whoever is that making such a noise? Whichever way must we turn? Whatever is the cause of the trouble?

Geography.

BOYS AND GIRLS.

(*Answer three questions only, including the first, if you can.*)

1. Draw a map of—
(*a*) Spain and Portugal ;
or (*b*) The coast of Europe from the Elbe to the Seine ;
or (*c*) The basin of the Ganges.

2. Describe the positions of Rome, Agra, Seville, Belgrade, Lahore, Calicut, and Dresden.

3. What are the chief productions of Ceylon, Assam, Lombardy, and Holland?

4. Explain the terms :—meridian of longitude, great circle, Arctic circle ; and explain how in going round the world from East to West a day is apparently lost. What is the difference in time between a place in 15° West longitude and another in 15° East Longitude?

5. Which is the healthiest and which the least healthy of the following English possessions :—Singapore, Calcutta, Sierra Leone, and Cape Town? Explain the physical causes of the healthiness or unhealthiness of each.

(2) *Rome*, about 16 miles from the mouth of the Tiber, west coast of Italy.
Agra, on the right bank of the Jumna, a tributary of the Ganges in India.
Seville, on the Gaudalquiver, in the province of Audalusia, Spain, about 60 miles north of Cadiz.
Belgrade, at the confluence of the Danube and Save in Servia.
Lahore, on the left bank of the Ravee, on the route between Delhi and Kabul.
Calicut, on the south west Malabar coast of India.
Dresden, on the Elbe in Saxony, 100 miles south-east of Berlin.

(3) *Ceylon* produces tea, coffee, sugar, rice, pepper, teak, cinnamon and other spices and cocoanuts : pearls in the Gulf of Manaar.
Assam produces tea, cotton, indigo, pepper and teak.

Lombardy produces wine, corn, maize, rice, cotton, silk and olive.

Holland produces wheat, madder, rye, flax, hemp, tobacco, beetroot, flower bulbs (hyacinths, tulips and crocuses).

(4) *A meridian of longitude* is a line connecting the poles, and is such that all places on it have their noon at the same time.

A great circle is a circle passing round the earth whose centre is also the centre of the earth.

Arctic circle, the circle which is drawn round the earth 23½° from the North Pole.

The day is supposed to begin at midnight at 180° E. of Greenwich. A place 180° W. of Greenwich will thus begin its day 24 hours *after* a place 180° E. As these may be said to be identical places, on crossing the meridian from 180° W. to 180° E., a day is lost.

The earth travels at the rate of 15° an hour or a degree in 4 mins. Between 45° W. and 15° E. is 60°.

The difference of time is therefore 60 × 4 = 240 mins. = 4 hours.

(5) Cape Town is the most healthy, Sierra Leone is the least healthy.

Cape Town is in the temperate zone and is situated on the sea coast. It is sufficiently removed from the Poles to escape great cold and is protected by mountains from the hot winds of Africa.

Sierra Leone is within the tropics, its coasts are low and swampy, and English people suffer greatly from malarial fevers owing to the vapours arising from these swamps.

Calcutta is unhealthy chiefly on account of the heat and the proximity of the swamps of the delta of the Ganges.

Singapore is a healthy town and district although within the tropics.

Penmanship.

BOYS AND GIRLS.

Write in large hand the word *Accurately*, and in small hand, *The shepherd swains shall dance and sing.*

(To be continued.)

Publications Received.

ARNOLD, EDWARD.—The Concrete Arithmetics. Standards III. and IV.

BACON, G. W., & Co.—The Excelsior Map of India; Fraction Diagrams, with Handbook (*Knight*).

BELL, G., & SONS.—Notes on Shakespeare's King John (*T. Duff Barnett, R.A.*).

BEMROSE & SONS.—Home Washing (*Louisa E. Smith*).

BLACKIE & SON.—The Myths and Legends of Ancient Greece and Rome (*Berens*).

CASSELL & Co. (Limited).—Anglo-American Art of Reckoning (*Howard*); First Latin Primer (*J. P. Postgate, M.A.*); Latin Prose for Lower Forms (*M. A. Bayfield, M.A.*); Science applied to Work (*Bower*).

CHAMBERS, W. & R.—Chambers's Expressive Readers, Book V.

CLIVE, W. B. & Co.—Herodotus, Book VI., with Introduction, Notes, &c.

CROSBY, LOCKWOOD & Co.—The Civil Service Geography (*Spence*).

DAWSON, A. G.—Teacher's Mental Arithmetic, Standards VI. and VII. (*Macnamara*).

EDUCATIONAL SUPPLY ASSOCIATION, THE.—The Practical Readers, Standards V. and VI.; 'Class Subject' Drawing Sheets; 'Class Subject' Drawing Copies.

FISHER UNWIN.—The Illustrated Poetry Book for Young Readers; The Story of the Nations: Vol. 24, The Jews under the Roman Empire (*W. Douglas Morrison, M.A.*); The Century Magazine. June.

KEGAN, PAUL, TRENCH, TRÜBNER & Co.—The Iliad of Homer (*Cordery*).

LAURIE, T.—Manual Training in France (*A. Salicis*).

LONGMANS & Co.—Junior School Algebra, with Answers (*Beard*); School Trigonometry (*Sparks*); A Smaller Commercial Geography (*Chisholm*).

MACMILLAN & Co.—English Men of Action: Havelock (*Archibald Forbes*); Short History of the English People, Part IV. (*J. R. Green*).

NATIONAL SOCIETY'S DEPOSITORY. — School Certificates; Scholarship Questions, with Hints and Solutions, 1887—1888—1889; Progressive Object Lessons for Infant Schools (*Taylor*).

PITMAN, I., & SONS.—Phonetic Journal, 17th May, 1890.

RELFE BROS.—A Class-Book of Geography (*W. Balfour Irvine*); Tables for Chemical Analysis (*Richardson*).

SAXON & Co.—Everybody's Scrap Book of Curious Facts (*Don Lemon*).

SMITH, ELDER & Co.—The Cornhill Magazine. May and June.

WARD, LOCK & Co.—Lippincott's Monthly Magazine. May.

Publications Reviewed.

Free Method in Elementary Schools: Suggestions offered to all Lovers of Children by One of Themselves. Lewisham: A. J. Roche.

There can be no doubt that the minute regulations of the Code tend to check the development of the most rational methods of true education in elementary schools, and to deaden the genuine enthusiasm with which many teachers enter upon their work. The removal of the most irksome of the restrictions that now have force would surely lead to the adoption of sounder, more varied, and more harmonious methods of teaching and training. In the wish to see the consummation of this desirable end we are in hearty sympathy with the anonymous author of this work. At the same time we feel bound to say that we have seldom, if ever, read a book of a serious kind on an important subject in which the matter has been apparently so ill-digested, the manner of its presentation so crude, and the style so loose and disjointed. Page after page bristles with peculiarities of punctuation, in which the dash and the parenthesis bear the chief share. Here are a few specimens of sentences such as occur with irritating frequency;—

'Whether taught through Writing, or not, children would soon pick up Reading, if supplied with books of the right kind,—giving simple narratives, dialogues, and tales,—(they are never tired of stories about animals),—and allowed, rather than required, to study. The use of multiplied copies of one book would seem to be the proper thing in Class-work, as enabling learners to keep together; but advantages so secured are balanced by greater loss than is suspected, though the lack of interest in the lesson, as ordinarily conducted, tells of something amiss. How would it be if each pupil were to get up his own subject—for the information and entertainment of the rest? Criticism might, or might not, be brought to bear upon such exercise—the merit of the reader being gauged, in part, through examination of his audience on the matter of the lecture;—it is likely, in any case, that the natural wish to interest companions, or to do justice to a favourite subject or author, would produce effective reading, with the proper "expression" so often hopelessly aimed at.' pp. 44—5.

'Managers should provide everything required—down to the smallest implements,—as children cannot be depended upon at first, and any little slip on their part produces a hitch,—a multiplicity of such (the likely thing) a serious inconvenience,—not to speak of awkwardnesses arising from the lack of uniformity, and risks involved in the daily carrying to and fro of books, slates, and pencils.' p. 56.

'It is the weariness caused by non-natural postures, and prolonged restraint,—more than any other cause, in all probability—that makes school so unpopular with children, generally,—felt all the more painfully, as contrasted with the wild life outside.' p. 57.

'Such a state of things is at least not inconceivable, if too rarely met with, and where it does exist, greater freedom of movement—as of speech—would be possible also, (after all),—easing conditions still further, and in the healthiest and happiest way for everybody concerned.' p. 58.

So we read on, paragraph following paragraph in the same slovenly, slipshod style. The only features that redeem it from utter condemnation as twaddling garrulity are, first the evident earnestness of the author, and secondly, the sensible character of many of the thoughts and suggestions so unmethodically and disconnectedly placed before the reader. If the plan of conducting a school were marked by method as free from all restraint as the style of the anonymous advocate of 'Free method,' we might have to describe it by an inversion of the observation of Polonius and say, 'there's madness in its method.'

The book opens with a long gossip, from which we have quoted sufficiently, on 'Principles in their connection with Practice.' Then follows a second on 'Practice as directed by Principles.' In this part the teaching of Morality, Writing, Spelling, Reading, Literature, Number, Needlework, Boys' Work, Singing, Movement and Drill are dealt with in succession. The last part is devoted to 'Teachers on Teaching.' If only for this part, the work is deserving of attention. More than a hundred pages are occupied with suggestive extracts from the Rev. Edward Thring's Theory and Practice of Teaching, from *Fors Clavigera* and other works of Ruskin, and from the evidence of teachers before the Royal Commission of 1886. We are sorry that we have had to find such fault with a writer so well-meaning as the author of this book, and at the same time we cannot but feel surprise that one who quotes with such thorough appreciation the eloquent sentences of Mr. Ruskin and the clear and vigorous remarks of Mr. Thring, should adopt a style so far removed from theirs.

The 'Long Life' Series: Health in Schools and Workshops. Edited by George Black, M.D. Edin. London: Ward, Lock and Co.

We have read this manual with great interest. The fourteen chapters on School Hygiene treat of such subjects as Emotional and Mental Strain, Bodily Growth, Amount of Study, Exercise, Care of the Eyes, School-Desks and Seats, and on these and other matters the reader will find very valuable remarks, which appear to be the result of wide knowledge and special study. The chapter on Exercise is particularly interesting. It contains information on physical education in Germany, Sweden and Switzerland, on the value of games, and on exercise for teachers, and is full of needful cautions about neglect of exercise and dangers attending its excessive or improper use. 'Children,' says the author, 'should have several hours of play every day in the open air, when possible. Vigorous and spontaneous action of this sort is better than gymnastics for the general run of children; and if girls were allowed by social feelings to play as boys do, they would cease to be so subject to spinal deformities.

'But a certain proportion of children are not suited by indiscriminate play. They have a tendency to distortion of the spine, which is easily brought out by many forms of sport.'

Another extremely important chapter is the one on Care of the Eyes. It would be well if all teachers were thoroughly acquainted with the facts here set forth.

The six chapters on Industrial Hygiene dealing with injurious inhalationa, tmospheric changes, accidents, hours of labour, and duration of life, have a less direct value for teachers, but are nevertheless full of interest.

Commercial Geography, Part I. Map Drawing and Projection. By John J. Cardwell. London and Manchester: John Heywood.

The fact that this work consists of the introductory lectures to the course of commercial geography and practical commerce at the Technical Schools of Manchester and Stockport is in itself sufficient commendation to those interested in the higher study of geography.

It may be laid down as an axiom that before anything like satisfactory progress can be made in the study of geography, acquaintance must be made with the principles underlying the construction of the maps in common use. The author has, therefore, given some account of the most important map projections, the data necessary for their projection, and the methods of construction, together with the elementary geometrical problems required. If this short geometry be mastered and the data understood, little difficulty will be experienced in the construction of the different map projections which follow, and with this knowledge nothing is better fitted for learning to draw maps from memory in correct relation to the lines of latitude and longitude than a slate on which the parallels and meridians have been indelibly marked. The methods for constructing a set of five slate projections are given, together with some figures illustrative of their use. By drawing upon a slate so constructed the outlines of two countries having about the same latitude, their relative sizes are at once made apparent.

The Three Principles of Book-keeping: A Popular Treatise on the Theory and Practice of Accounts. By J. G. Chaplin. London: Sampson Low and Co.

The claim which this work makes on our attention is based on the manner in which the essential points in the subject are presented. By reducing Book-keeping to its simplest elements it is made easy of intelligent comprehension. Book-keeping is defined as 'the art of recording facts about property as measured by money.' The essence of this art is shown to be a correct classification of the facts recorded. The three principles recognised as essential and of universal application are, first—'The record of facts in separate classes—Ledger accounts—which are Personal or Impersonal, as they relate to Persons or Things;' second—The separation of Ledger Entries into the two classes of Debits and Credits'; and third—'The Double Entry of every fact,' which forms 'the keystone of the arch.' In a thoroughly systematic manner it is shown how all the operations in Book-keeping are merely subsidiary to the carrying into practice of these three principles. The volume traces out the application of the principles to the various classes of commercial transactions, and shows clearly how modifications in practice arise, and so guides the attentive reader to understand the best way of meeting the special needs of any business. At intervals valuable notes are given on the numbered paragraphs of the text, and the whole is followed by an extensive index. The book is likely to be found useful by any student of the art of keeping accounts.

Local Examination History. By Dr. R. S. Pringle. Manchester: John Heywood.

This book has reached its eleventh edition and the notes have been brought down to the present time.

The Analytic Composition Series: Pleasant Stories for Composition, with Hints and Suggestions. By Robert S. Wood. London: A. G. Dawson.

This book consists chiefly of a collection of 126 short stories of the sort usually given as exercises in composition for Standard V. in elementary schools. Nearly all the Stories are very suitable in respect of interest and pointedness; and many are really good examples of wit and humour. As to length they are remarkably well-adapted to their purpose, each story as a rule occupying half a page of the book. We notice a few slips which should not occur in a work of this kind. On page 19 we read of a lady buying her own umbrella, 'which she had lain on the counter;' on page 37 'homelesson' is printed as a single word; and on page 53 'its' is used as a contraction for 'it is.' Here and there we come upon a story of doubtful good taste, as No. 34 and No. 39, and a few of the stories tend perhaps to the undue glorification of sharp practice. The heading 'Pleasant Stories' can only be applied to the two on page 11 with grim irony.

'Hints and Suggestions on Method for the Teacher' occupy the latter part of the volume, and will be found very useful. The plans and devices for teaching a subject admitted to be difficult, and necessarily so, for most young children in elementary schools, are numerous and ingenious.

The Public Examination French Classbook. By Marius Deshumbert. London: David Nutt.

The author has made a collection of French and English extracts extending over above two hundred pages for the use of candidates preparing for examination. Beyond an occasional reference to a proper name, or an allusion on which the ordinary dictionaries would be silent, the author has chosen to give no notes. He does not believe in notes. They give too much help, and the student often relies on them to such a degree that, in the end, he cannot do without them. We believe there is a great deal of truth in this contention. But between a fully annotated text and one with scarcely any notes at all the difference is great. The truth seems to us to lie between the two extremes. There are a few pages at the end on examination grammar questions.

The smaller Cambridge Bible for Schools—The Gospel according to St. Mark. Dr. Maclear. **The Gospel according to St. Luke.** Dr. Farrar. London: C. J. Clay and Sons.

These are indeed excellent manuals. But for one drawback they might have been described as perfect. They have been prepared by men of great learning and judgment. Perhaps it is not too much to say that they are equal to anything that has been placed within the reach of the upper forms of middle class schools.

The objection we urge, and with us it is a most serious one, is the smallness of the print. The over-crowding is specially apparent in the notes. But the text itself is little better. Surely this is a serious blunder. Compared with the modern reprints of detached portions of English literature, the effect of the pages of the smaller bible for schools is depressing. Instead of using a bold type, a wide margin, frequent open spaces in the notes, the whole page is covered with small print. Nothing can be more certain to prevent the books becoming popular.

We fear that the value of a great undertaking has been to a large extent lost from considerations of expense. The syndics of the University press are no doubt an august body, combining wisdom with enterprise. We venture to suggest that if they had taken the opinion of a few schoolmasters they would have been saved from the fatal blunder of spoiling an excellent work.

Geographical Terms (exemplified by a Map of England). London: G. W. Bacon and Co.

Although there is nothing strikingly original in this chart, there is much that is useful. The idea which has here been carried out is to exemplify the meanings of the various terms met with in an elementary course of geography by reference to various parts of England and Wales. One advantage of this plan is that the information afforded is of a 'double-barrelled' nature. For instance, taking the case of the map now before us, the pupil not only learns the meaning of the word 'fen,' but learns also that the country around the Wash is 'fenny;' and in addition to seeing how a range or chain of hills is indicated on a map, he finds out also that such a range is to be found stretching like a backbone through the northern counties of England. The only drawback in selecting such a map as that of England for the purpose of illustration seems to be the impossibility of obtaining in it examples of such terms as archipelago, volcano, delta, &c., without drawing upon the imagination and introducing features which are not actualities. The entire omission of illustrations of such terms, as in the map now before us, is preferable to the introduction of fictitious examples.

Charts of the Human Body. London: G. W. Bacon and Co.

We have here three charts designed to be illustrative and elucidatory of elementary lessons in the anatomy, physiology and hygiene of the human body. Chart No. 1 deals with the osseous structure of the frame; Chart No. 2 is devoted to the organs of the trunk, the muscles of the limbs, the skin, and the blood; while Chart No. 3 illustrates the organs of the senses. The illustrations are clear and effective, the colouring decided, and altogether the sheets seem well adapted for the purpose intended. It may be remarked that the various figures are numbered consecutively throughout the three charts, in order to avoid the confusion attendant on beginning with No. 1 on each sheet. We are glad to note that a special drawing is introduced to illustrate the deformation of the human form by tight-lacing. To use the words of the little handbook which accompanies the sheets, 'this figure speaks for itself'; and we venture to express the hope that this picture of distorted ribs and displaced organs may induce many to leave their waists natural who otherwise would 'follow the fashion.'

Periodical Examination Report Form. By T. J. MACNAMARA. London: A. G. Dawson.

This is a large sheet for entering results of a full examination of all the Standards at the monthly examination. It has the objection that it may be examined by persons entirely ignorant of the circumstances of the classes, and a teacher may be hurt in feelings and reputation through no fault of his own. It gives the percentage of passes in each subject, and the teachers are judged and placed in order on the sheet according to this percentage. Mr. Macnamara has spoken and written against this method of estimating the work of a teacher as much as anyone during the past few years, and yet he perpetuates the fallacy in this broad sheet. If, for the information of the teachers alone, it may serve a good purpose, but we should be sorry to encourage its use for affixing in the schoolroom.

Blackie's Elementary Text Books: Light, Heat and Sound. By C. H. Draper, B.A., D.Sc. London: Blackie and Son.

This is a well printed and neatly illustrated book. The statements are clear and accurate. We can cordially recommend it.

Exercises to accompany the School German Grammar. By H. W. Eve, M.A., and Alice Zimmern. London: David Nutt.

The object of these exercises is to supply a link between the short easy sentences in grammar books for beginners, and continuous prose composition. They are full of references to the German grammar by Mr. Eve, to which they are intended as a companion book. The course is progressive and very thorough. No one who has worked carefully through them, can fail to have obtained a good insight into the manifold difficulties of German construction. The collaboration of an Englishman with a German lady gives this book almost a unique position. Both the German and the English in it are correct and correctly idiomatic. Of how many books of this class can the same be said in every detail?

Euclid's Elements of Geometry. By H. M. Taylor, M.A. The Cambridge University Press.

The Pitt Press committed the preparation of the small volume before us into the very able hands of Mr. H. M. Taylor. The result has been highly gratifying. The way in which the propositions are set out and the demonstrations arranged will be of the greatest service, both for the pupil and the teacher. Exercises are inserted in the body of the text as though they were intended to be worked. One imagines, on taking the book up for the first time, that there is not much change in the traditional way of treating the subject. The more it is examined, however, the more one sees the amount of thought expended upon the book. We should say that nothing has been introduced which did not only seem advisable but necessary. The book is not large, but it is one of high merit.

Magnetism and Electricity. By Messrs. J. Harrison and C. A. White. London: Blackie and Son.

This is a book which will be found to be useful and trustworthy. It is the work of men who are engaged in teaching, and who know the necessity for clearness and simplicity.

In the preface they tell us that nearly all the experiments described can be repeated by using articles to be found in almost any house, or which can be purchased at a trifling cost. We think it is a pity that suitable directions for doing this were not more freely introduced. The illustrations are all of them good, but they are in the main figures of well known pieces of apparatus not always of a kind which could be imitated with simple and cheap materials.

Photo-Relief Map of Scotland. London: G. W. Bacon and Co.

For rapidly impressing upon youthful minds the physical features of a country few things are more effective than a photo-relief map; and we therefore view with pleasure, in connection with the small map now before us, a praiseworthy attempt to bring productions of this nature within the reach of all. Being clearly printed, with good development of light and shade, and being strongly mounted, this map should prove a valuable aid to lessons in elementary geography.

Excelsior Map of Palestine. London: G. W. Bacon and Co.

On this sheet are shown in juxtaposition two maps of Palestine, the one illustrative of Old Testament History, and the other of the New. Both maps are creditable productions, presenting just those features of clearness of outline, judicious colouring, and general legibility, which go to form a satisfactory adjunct to class work. Submaps are added to illustrate the wanderings of the Israelites and the travels of St. Paul.

Fifty Examinations in Mental Arithmetic. By a Head Master. Manchester: John Heywood.

This book has reached a third edition. It contains excellent examples for all the Standards as well as explanation of the various methods adopted in mental calculation.

The Century Arithmetics: Standard V. London: Blackie and Son.

This is a book of 40 pages of suitable examples for Standard V. Like the others of the series it is in limp cloth and has the whole of the tables and code requirements printed on the covers.

Chamber's Expressive Readers: Book V. Edinburgh: W. and R. Chambers.

Book V. of the Expressive Readers is as good as its predecessors. It has 180 pages of suitable reading matter, easy and agreeable for children of the Fifth Standard. In addition there are 20 pages of poetry and 56 pages of spelling and grammar exercises. The reading lessons consist of some old friends with new faces, as well as new pieces, and endeavour is made to combine the continued narrative with the occasional or detached piece. The book can be well recommended.

Vere Foster's Bold Writing Series: No. 13½. London: Blackie and Son.

This new number of the series is ruled double small and is a very good copy book for Third and Fourth Standard children. The head-lines are noted places in Scotland.

Tables for Chemical Analysis. By A. T. Richardson, B.A. London: Relfe Brothers.

These are a set of tables well printed on stout paper. There is no preface to explain the aim of the author. So far as we can see they are intended for those who are studying compounds containing one acid and one base. There are no exercises or questions upon the principles which underlie the methods adopted.

Longmans' New Historical Readers: Sketches from British History for Standard IV. By F. York Powell, M.A. London: Longmans, Green and Co.

The matter of the lessons in this volume possesses considerable freshness, and the style is very far removed from that of the dry-as-dust text-books, which are sometimes made to do service for historical readers. Mr. York Powell introduces traditional tales of Ireland and Scotland as well as of England, and young readers cannot fail to be interested in the sorrows of Deirdre, the stories from Bede, and the exploits of Robin Hood. The progress of our country from a semi-barbarous condition is skilfully traced. The biographical element is freely introduced, and while chapters on Chaucer, Shakespere and Sidney, and John Milton, illustrate the growth of literature, the records of the deeds of John Howard, of Bentham, and of General Gordon set before the reader bright examples of loyalty, courage, and self-sacrifice, such as are so plentiful in our annals. The volume is particularly well printed, well illustrated, and well bound.

Owing to pressure on our space we are compelled to hold over 'Practical Perspective for Pupil Teachers,' by E. G. Baker, B.Sc., B.A., as well as several reviews.

'A Paper on Paraphrasing,' by C. J. Dawson, B.A., appears this month in place of the 'Short Studies in English Literature.'

Mr. Dawson's new work on 'Essays, Essay-writing and Paraphrasing,' will shortly be published by Mr. Joseph Hughes. A specimen copy will be sent on the day of publication to any head teacher upon receipt of a P.O. for 1s. 6d.

CITY OF LONDON DAY TRAINING COLLEGE.

WHITE STREET, MOORFIELDS, E.C.

(Two minutes' walk from Moorgate Street Station, 5 from Broad Street, Liverpool Street, and the Bank.)

CERTIFICATE, 1890.
SCHOLARSHIP, 1890.
PUPIL TEACHERS' CENTRAL CLASSES.

Approved by Education Department and recommended by H.M.I.

These Classes commence on SATURDAY, January 11th.

New Students can be admitted to the following classes also, on same date :—

TONIC SOL-FA; 'D' CERTIFICATE; NEEDLEWORK DIPLOMA; DRESSCUTTING, &c.; MUSIC; LANGUAGES; MATRICULATION; B.A.; B.Sc.; OXFORD AND CAMBRIDGE JUNIOR, SENIOR, and HIGHER LOCALS; L. L. A., ST. ANDREW'S; KINDERGARTEN CERTIFICATE; SCIENCE.

Tuition by Correspondence for all Exams.

Owing to the continual increase in the number of Students in all classes, it becomes necessary to establish a separate

CORRESPONDENCE DEPARTMENT

with very much improved arrangements. In this Department the following Tutors, as Specialists, will be responsible for the subjects set opposite to their names :—

SCHOOL METHOD and LOGIC. ... ... } Mr. C. W. CLAYSON, B.A., London University; Matriculation Honours, London University.

MATHEMATICS (Algebra, Euclid, and Mensuration).—Mr. POLLARD WILKINSON, B.A., B.Sc., London University; Matriculation Honours, London University.

ARITHMETIC.—Professor CUSACK.

ENGLISH GRAMMAR and LITERATURE.—Mr. J. W. SAMUEL, B.A., Lond. Univ.; Matriculation Honours, Lond. Univ.

PENMANSHIP.—Professor CUSACK.

GEOGRAPHY and HISTORY.—Mr. PERCY W. RYDE, Special College Lecturer in these subjects.

NEEDLEWORK.—Miss AMY K. SMITH, Diplomée of the London Institute for the Advancement of Plain Needlework.

SCHOOL HYGIENE and DOMESTIC ECONOMY.—Mr. P. W. RYDE, Special College Lecturer in these subjects.

POLITICAL ECONOMY.—Professor CUSACK.

SCIENCE.—Mr. GEORGE HORSFALL, B.A., B.Sc., Lond. Univ.; Matriculation Honours, Intermediate Arts Honours, London Univ.

DRAWING.—Mr J. VAUGHAN, Art Master, South Kensington; Specialist under London School Board.

LANGUAGES.—Professor CUSACK.

MUSIC.—Mr. W. R. PHILLIPS, R.A.M., Fellow and Examiner, Tonic Sol-fa College.

All names for Certificate or Scholarship, 1890, should be entered at once, and not later than 11th of January.

First set of papers will be sent off on 15th of January.

Owing to the unequalled successes attained for a series of years, the Principal is now able practically to **GUARANTEE SUCCESS** to all Certificate and Scholarship Students who begin with their course, and do the work prescribed weekly by the respective Tutors.

All applications for Prospectus, &c., to be addressed to

PROFESSOR CUSACK.

Tuition by Correspondence

ESTABLISHED 1871.

PUPILS may now be entered for Certificate (1st and 2nd years), Scholarship, Science and Art, Matriculation, A.C.P., and Musical Examinations.

Pupils for Certificate (2nd year men) may take the course for Mathematics only, if desired.

Scripture (for December and July), Languages, Special Subjects, Shorthand, Book-keeping, &c., from 10s. per quarter.

We draw attention to our Courses for Pupil Teachers, Army Schoolmasters and Mistresses, Civil Service Branches, Medical and Legal Preliminary, and to our new department 'Notes and Queries.'

Intending Students and Enquirers (for whatever subject or branch) should write at once to our Office, naming this paper.

Address, JAMES JENNINGS and Co., Tuition by Correspondence Office, Deptford, London.

MR. MURRAY'S
LIST OF SCHOOL BOOKS,

FOR STUDENTS OF ALL AGES.

DICTIONARIES OF THE BIBLE AND CHRISTIAN ANTIQUITIES AND BIOGRAPHY: LATIN, CLASSICAL, BIOGRAPHICAL. With many Illustrations, and in different sizes to suit all requirements.

GRAMMARS. LATIN, GREEK, ENGLISH, FRENCH, GERMAN, HEBREW, AND ITALIAN, affording the simplest and most rapid means of learning the languages.

HISTORIES OF ALL COUNTRIES AND AGES. With Maps and Illustrations.

DR. WM. SMITH'S 'PRINCIPIA' SERIES FOR LEARNING LATIN, GREEK, FRENCH, GERMAN, &c., on the same system.

THE ETON COLLEGE NEW SERIES OF SCHOOL BOOKS.

SCIENCE. 'The Invisible Powers of Nature,' and other works on GEOLOGY, NATURAL PHILOSOPHY, PHYSIOLOGY, MATHEMATICS, &c.

MANUALS OF GEOGRAPHY, LITERATURE, PHILOSOPHY, COMPOSITION, &c., FOR ADVANCED OR ELEMENTARY STUDENTS.

COMPOSITION AND EXERCISES IN ENGLISH, FRENCH, GERMAN, ITALIAN, LATIN, GREEK, AND HEBREW.

***** Catalogues containing full description of all these Works, with numerous Illustrations, sent on application to the Publisher.**

JOHN MURRAY, ALBEMARLE STREET, LONDON.

DRAWING BY CORRESPONDENCE.

Eleventh year. Great success in 1889. 34 'D's' were completed. Freehand, Model, Solid Geometry, Perspective, Light and Shade, now being taken for the May and October Exams. Holders of 'D's' should take up Light and Shade. 30 unsolicited testimonials. Send stamped addressed envelope for prospectus, &c., to G. H. HEATHCOTE, 5, TREMANDOC ROAD, CLAPHAM, LONDON, S.W.

CERTIFICATE, 1890.

Thorough preparation. All Subjects. Best possible help. Lowest possible fees.

CERTIFICATE MATHEMATICS.

Why fail? Course in fourteen weeks. 'Just to the point.' Write for Prospectus.

Address :—'TUTOR,' KIDSGROVE, STOKE-ON-TRENT.

Just Published. Price ONE SHILLING.

SCHOOL HYGIENE.

Including Simple Directions respecting Ventilation, Eyesight, Infectious Diseases, and First Aid in Injuries. For Schools and Families. By W. JENKINSON ABEL, B.A., Clerk to the Nottingham School Board.

LONDON: LONGMANS, GREEN & CO.

Post 8vo. Strongly bound. Price 7s.

CAREY'S
'GRADUS AD PARNASSUM.'

With the English Meanings. Recently Revised, Corrected, and Augmented by a member of the University of Cambridge.

London: Published by the Stationers' Company, Stationers' Hall, Ludgate Hill.

Just Published, price 3s. 6d.

MODELS FOR LATIN PROSE COMPOSITION,

Selected from the Best Authors,

By J. OLIVER, Bombay Educational Department.

A. J. COMBRIDGE & CO., 31, Newgate St., E.C.

J. KEEFE, F.R.G.S., F.S.Sc. (London), &c.,

63, BOLD STREET, LIVERPOOL: also at MANCHESTER.

ACADEMY for Civil Service Clerkships, Naval Cadetships, Engineer Students, Ceylon and Hong Kong Cadetships, Army Preliminary, and Factory Inspectorships; also for Banks, Business, Medical and Legal, Preliminaries, and all Professional Examinations. Over 450 successes. TUITION BY CORRESPONDENCE for Country Students.

Prospectus Free.

'QUEEN'S SCHOLARSHIP EXAM.'

Candidates thoroughly Trained by Correspondence. No Fee unless successful first time. Backward students made to pass, and bright ones pushed into First Class.—Addressed envelope for particulars, list of successes, &c.

GEORGE HENRY SPARROW, Forest Gate, London, E.

N.B.—This being the eighth year of coach, with increasing success each year, there is little fear of failure.

MADE WITH BOILING WATER.

EPPS'S

GRATEFUL—COMFORTING.

COCOA

MADE WITH BOILING MILK

47th YEAR OF PUBLICATION.

USED IN THE LONDON BOARD SCHOOLS.

REDUCED FAC-SIMILE OF COVER.

WIGHTMAN'S ARITHMETICAL TABLE BOOK

NEW EDITION.

ENLARGED TO CROWN 16mo.

40 pages.

Many Million copies of this valuable little work have been sold.

MAY BE HAD OF

SIMPKIN MARSHALL & Co.; KENT & Co.; HAMILTON ADAMS & Co.;

OF THE PRINCIPAL SCHOLASTIC AGENCIES,

AND OF THE PUBLISHERS

WIGHTMAN & Co., 104 & 106, Regency Street, WESTMINSTER, LONDON.

ACTION SONGS FOR SCHOOL CONCERTS.

FULL SONG SIZE. VOICE PART IN BOTH NOTATIONS. AMPLE DIRECTIONS FOR ACTIONS.

Village Minstrels are we ... ... C. H. LEWIS ... 1s.
Humorous refrain, to be sung through combs covered with paper.

The Jolly Jack Tar ... ... C. H. LEWIS ... 1s.
Boys haul ropes, imitate holding oars, and rowing.

The British Flag ... ... PERCY JACKMAN 1s.
Picturesque flag drill. (Flags sold by the Publishers.)

The Chinaman ... ... A. L. COWLEY... 1s.
Simple actions, nodding, arm motions, &c.

The Chinese Umbrella ... ... C. H. LEWIS ... 1s.
Umbrella drill. (Paper umbrellas sold by the Publishers.)

Grandmother's Dream ... ... F. L. BRISTOW 1s.
Girls imitate grandmother spinning, washing, rocking, &c.

The Japanese Fan ... ... A. L. COWLEY.. 1s.
Fan drill and pretty grouping. (Fans sold by the Publishers.)

Merry Little Maids and Merry Little Boys. A. L. COWLEY ... 1s.
Boys and girls, in separate verses, act their school work.

Nelly's Dolly ... ... A. WATSON ... 1s.
Girls rocking, dressing, and talking to their dolls.

The Tinker's Song ... ... A. L. COWLEY... 1s.
Soloist dressed as working tinker. Accompaniment of tin kettles and iron bars or anvils.

We are Jolly Blacksmiths ... ... C. H. LEWIS ... 1s.
Two-part song. Accents in chorus marked by beating two anvils.

Castles on the Sand... ... ... PERCY JACKMAN 1s.
Imitating seaside occupations: digging sand, lifting bucket, shouldering spade, &c.

Merry Drummers ... ... PERCY JACKMAN 1s.
Marching and drilling to the tap of the drum.

LONDON:

J. CURWEN & SONS, 8 & 9, Warwick Lane, E.C.

Catalogue sent free on Application.

EYRE & SPOTTISWOODE'S

Drawing Instruments,

WATER COLOURS, OIL COLOURS,

SETS OF GEOMETRICAL MODELS,

Small, Medium and Large.

Pencils, Crayons, Indian Ink, Brushes, Palettes, Slant Tiles, Dippers, Water Bottles, Drawing Boards, T-Squares, Set Squares, Drawing Paper, Canvas, Panels, &c., and Artists' Materials of every description.

LIBERAL TERMS FOR SCHOOLS.

HEYL'S ARTISTS' OIL COLOURS.

LIBERAL TERMS FOR QUANTITIES.

SOLE AGENTS FOR THE UNITED KINGDOM,

EYRE & SPOTTISWOODE,

LONDON—Great New Street, Fleet Street, E.C.

BRITISH MUSEUM 31 MY 90